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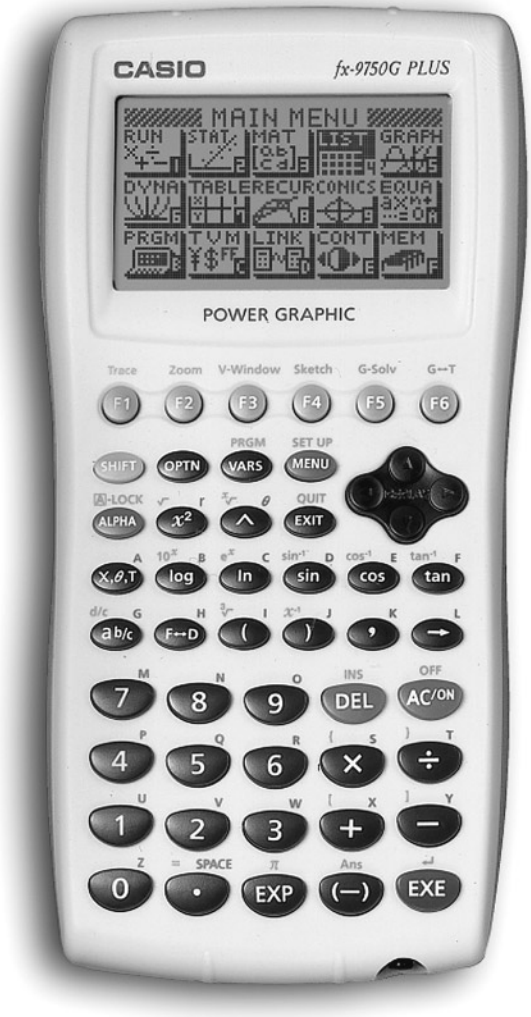
STATISTICS

with the Casio FX-9750G Plus



- Univariate Data
- Two-variable Statistics
- Linear Bivariate Data
- Non-linear Bivariate Data
- Probability- Combinations
- Probability- Permutations
- Random Sampling
- Categorical Data
- Normal Probability
- Hypothesis Testing
- Confidence Intervals
- Chi-Squared
- Probability Distributions
- Simulations

Activities for the Classroom

All activities in this resource are also compatible with the Casio CFX-9850G Series.

STATISTICS

with the

Casio FX-9750G Plus

Miki Merritt

CASIO®
the unexpected extra™

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www.casio.com 9750-STAT

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Activity 1
Blowing Bubbles

Teaching Notes

Topic Area: Univariate Data

NCTM Standards:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
  - Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable (9-12)
  - Understand histograms, parallel box plots, and scatterplots and use them to display data (9-12)
  - Compute basic statistics and understand the distinction between a statistic and a parameter (9-12)
- Select and use appropriate statistical methods to analyze data
  - Find, use, and interpret measures of center and spread, including mean and interquartile range (6-8)
  - For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics (9-12)

Objective

The student will be able to calculate univariate summary statistics, make conjectures based on these statistics, and display the results in a box plot.

Introduction

You may want to use the following description or personalize it for yourself to introduce the activity to the students.

"A friend of yours has not been too successful with blowing bubbles with her bubble gum in the past. This sparks a question in your mind about how big most people can blow bubbles. You realize that you could do an experiment and calculate some simple statistics to help answer your questions."

You could also have the students create the experiment themselves. Setup the classroom so that students can easily access a partner. You could have them find their own partner, assign partners at the beginning of the activity, or use an already established means of assigning partners.

The students should be familiar with the following vocabulary:

Univariate	Interquartile range
Mean	Conjecture
Box and whiskers	Histogram
Median	Mode

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Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator, one piece of bubble gum for each student, and a small ruler for each pair of students. Hubba Bubba® and Bubble Yum® bubble gums work well, usually better than off brands for blowing bubbles.

Off brands of bubble gum work somewhat well and lose flavor quickly which could be a benefit to your management of bubble blowing after the activity is complete. You could also have your students bring packs of gum for extra credit. Also, to help with classroom management, you might prefer to have the students throw their gum away as soon as they have completed their measurements.

If you would prefer your students not do the activity themselves, have them do the calculations and questions with the sample data. In that case, the answers to the questions are included in the activity worksheets. If you do not want the students to have the solution in front of them, just give them the sample data and the set of questions to answer from the first page of the Student Activity sheet.

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Name _____ Class _____ Date _____

Activity 1 • Blowing Bubbles

Introduction

Find a partner to do this activity with. Chew your piece of bubble gum for a minute or two until it is soft enough to begin blowing bubbles. Blow a bubble and hold it, allowing your partner to measure its diameter in centimeters as carefully as possible. Turn to your partner and do the same with his/her bubbles. You will have 20 bubble measurements total. Share your bubble measurements with the class so that you have class data to answer the following questions.

Problems and Questions

1. Find the mean, median, mode, and quartile ranges of the class data.

   Mean: _____

   Median: _____

   Mode: _____

   Quartile 1: _____

   Quartile 2: _____

   Quartile 3: _____

   Quartile 4: _____

2. Create a box-and-whiskers graph of the class data. Draw the box-and-whiskers graph and label it in the box below.

3. What does the mean represent in this case?

   _____

4. What is the largest quartile range? What does this mean?

   _____

5. If someone in the class were to blow another bubble, what size do you think it would be?

   _____

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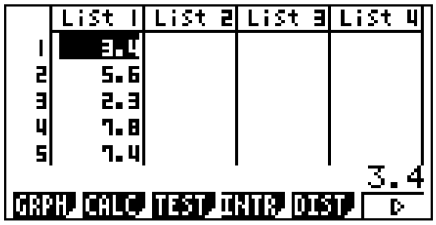
Solutions and Screen Shots for Activity 1

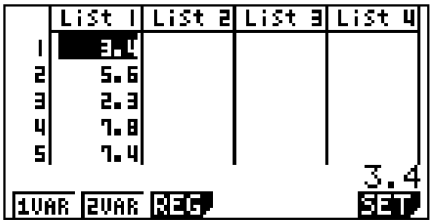
Example Bubble Diameter Data Diameter (cm)			
3.4	6.5	3.7	2.9
5.6	5.4	4.8	5.1
2.3	3.0	6.0	6.6
7.8	7.2	5.9	7.4
7.4	2.6	6.3	4.4

To calculate the mean, median, mode, and quartile ranges of the bubbles:

1. Enter the diameters of the bubbles into List 1.
   - From the Main Menu (if it is not showing, press **MENU**) press **2(STAT)**.
   - In the first cell of the first column, type in the size of the first bubble, press **EXE** to store.
   - Continue until all bubble sizes are entered.



2. Press **F2(CALC)**, **F6(SET)**. Make sure 1Var XList is set for List1 by using the arrow keys and pressing **F1**.



3. Press **EXIT** to return to the previous screen. Press **F1(1VAR)**.

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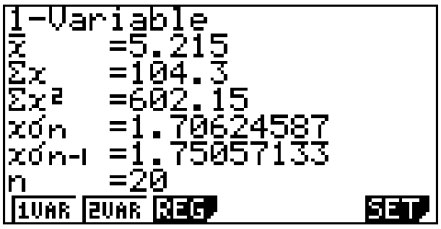
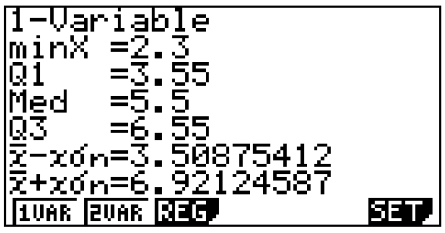
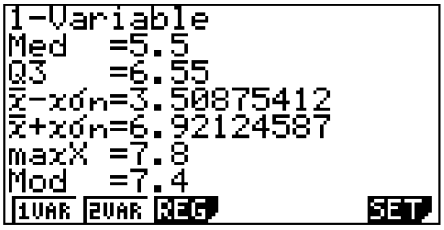
Solutions and Screen Shots for Activity 1
(continued)

The 1-Variable statistics will be displayed, press the down arrow key to view more of the statistics. The following list is the numbers you are looking for.

- $\bar{x}$ is the mean
- Min is the minimum (or beginning of the first quartile range).
- Q1 is first quartile (or end of the first and beginning of the second quartile range).
- Med is the median (or end of the second and beginning of the third quartile range).
- Q3 is third quartile (or end of the third and beginning of the fourth quartile range).
- Max is the maximum (or end of the fourth quartile range).
- Mod is the mode.

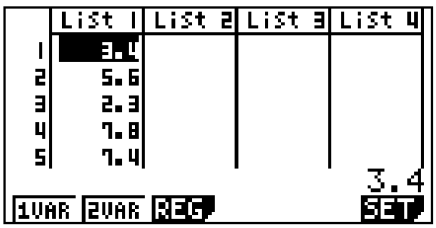


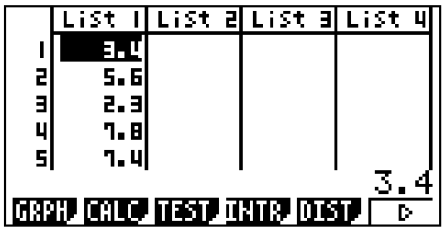




To create a box-and-whiskers plot and find the quartile ranges:

1. Press **EXIT**, **EXIT**.





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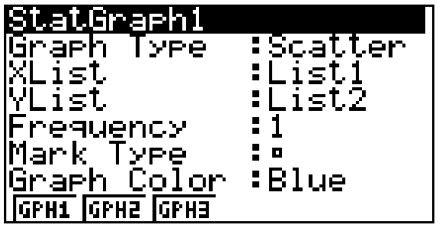
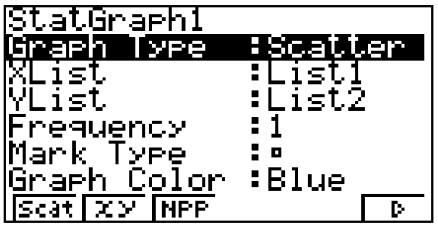
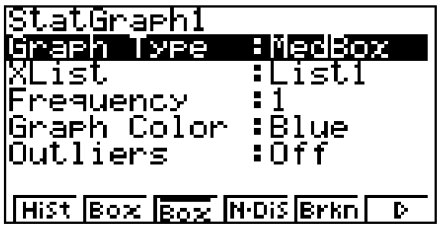
2. Press **F1(GRPH)**, **F6(SET)**.

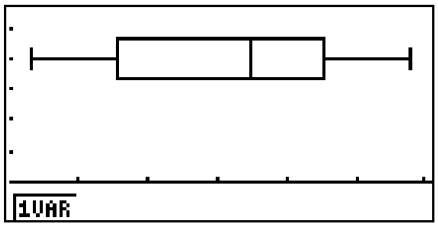


3. Arrow down to Graph Type and press **F6**, **F2(BOX)**. Arrow down **F1(List 1)**, **EXE**.

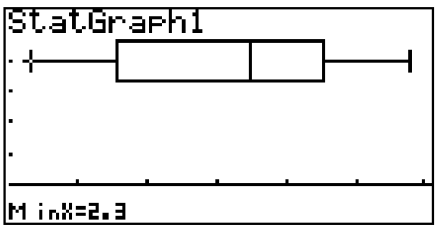




4. Press **F1(GPH1)** to view the box-and-whiskers plot.



5. Press **SHIFT F1(Trace)** and the arrow keys to find the quartiles.



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Activity 2
World Cocoa Market

Teaching Notes

Topic Area: Two-variable Statistics

NCTM Standards:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
    - Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable (9-12)
    - Understand histograms, parallel box plots, and scatterplots and use them to display data (9-12)
    - Compute basic statistics and understand the distinction between a statistic and a parameter (9-12)
- Select and use appropriate statistical methods to analyze data
    - Find, use, and interpret measures of center and spread, including mean and interquartile range (6-8)
    - For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics (9-12)

Objective

The student will be able to calculate summary statistics for two sets of data simultaneously, make conjectures based on these statistics, and display the results in parallel box plots.

Introduction

You can make this more dramatic by drinking a cup of hot chocolate in front of the room. This will probably only work if you do not drink coffee or some other beverage in front of your class on a regular basis. You could also have a few packets of cocoa mix and pass around to your class. Ask them how much cocoa they think the world uses in a given year. You could also use the following to help engage your students in the activity.

"Everyone likes a nice cup of hot chocolate or some brownies. To make both of those you need cocoa. As you sip a cup of hot chocolate you begin to wonder how much cocoa is used in the world today. You could go on a search and find a website that gives world cocoa market statistics."

The students should be familiar with the following vocabulary:

Univariate	Conjecture
Mean	Mode
Median	Parallel box-and-whisker plots
Ratio	Standard deviation of sample
Bivariate	Standard deviation of population

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Getting Started

In this activity you will need the **Casio fx-9750G Plus** graphing calculator and a sample set of data. If you would like updated data for the World Cocoa Market, visit the following website: www.dailyfutures.com/softs. The latest statistics on the cocoa market is on that page. Arrow down and copy down the net production statistics and the grindings statistics for each of the years listed in the chart. If you do not have internet access in your class, have the students use the sample data.

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Name _____ Class _____ Date _____

Activity 2 • World Cocoa Market

Introduction

To find a set of data for this activity, go to the following website: www.dailyfutures.com/softs. The latest statistics on the cocoa market is on that page. Arrow down and copy down the net production statistics and the grindings statistics for each of the years listed in the chart.

Problems and Questions

1. Find the average net production and grindings.

   Average Net Production _____ Average Grindings _____

2. What is the ratio between those two numbers? _____

   What does this ratio represent? _____

3. Find the following information about net production and grindings:

   a. Mean

      i. Net Production: _____

      ii. Net Grindings: _____

   b. Standard Deviation of sample

      i. Net Production: _____

      ii. Net Grindings: _____

   c. Standard Deviation of population

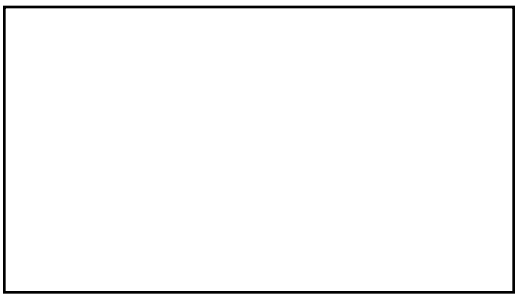
      i. Net Production: _____

      ii. Net Grindings: _____

4. What do the mean, standard deviation of sample, and standard deviation of population represent for net production and grindings?

   _____

5. Create parallel box-and-whisker plots for net production and grindings. Compare and contrast the two plots. Draw and label the plots in the space below.



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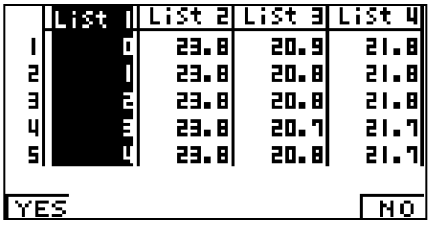
Solutions and Screen Shots for Activity 2

World Cocoa Market Statistics (in million metric tons)									
Year	1996	1997	1997	1999	2000	2001	2002	2003	2004
Net Production	2.91	2.67	2.67	2.77	3.03	2.83	2.86	3.14	3.42
Grindings	2.66	2.75	2.75	2.78	2.96	3.04	2.88	3.05	3.18

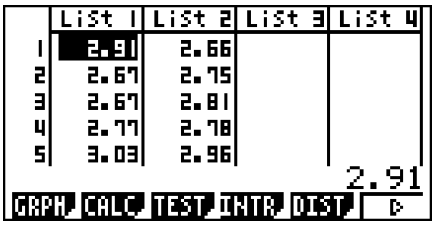
(from www.dailyfutures.com/softs)

To calculate the mean, median, mode, and standard deviation of net production and grindings:

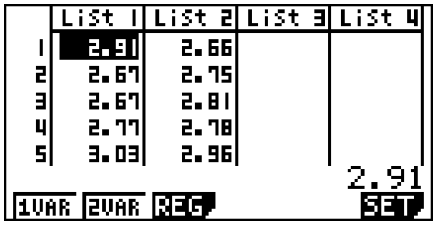
1. Delete any data that is currently in the lists.
   - Press the **AC/ON** button, from the main menu press **2(STAT)**.
   - If you have data in your lists, place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



2. Enter the Net Production data into List 1 and Grindings data in List 2.
   - Enter data for Net Production into the first cell of List 1, **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Grindings in List 2.



3. Press **F2(CALC)**, **F6(SET)**. Make sure that 2Var XList is set for List1 by highlighting it with the arrow keys and pressing **F1**. Make sure that 2Var YList is set for List 2 by pressing **F2**.



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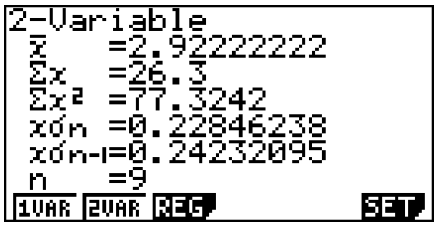
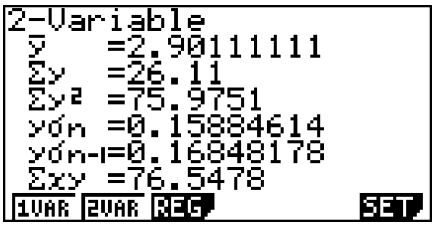
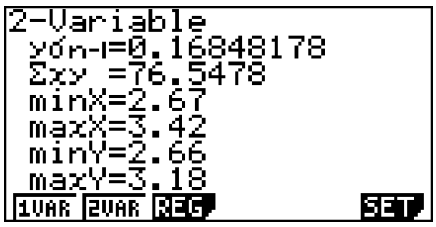
4. Press **EXIT** to return to the previous screen. Press **F2(2VAR)**.

The 2-Variable statistics will be displayed. Use your down arrow keys to view more statistics.

- $\bar{x}$ and $\bar{y}$ are the mean values
- xσn, yσn, xσn–$_1$, and yσn–1 are the standard deviation values

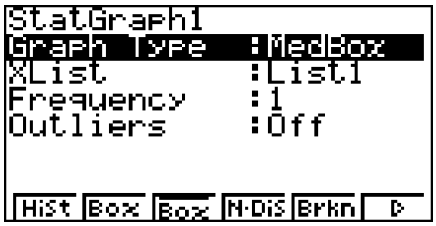




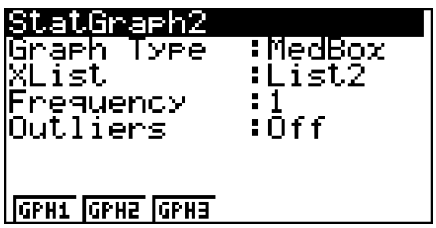


To create a box and whiskers plot and find the median and quartile ranges:

1. Press **EXIT**, **EXIT**.
2. Press **F1(GRPH)**, **F6(SET)**.
3. Arrow down to Graph Type and press **F6**, **F2(Box)**.
4. Arrow down to XList and press **F1(List1)**.



5. Arrow up to StatGraph1 and press **F2(GPH2)**.
6. Arrow down to Graph Type and press **F6**, **F2(Box)**.
7. Arrow down to XList and press **F2(List2)**.



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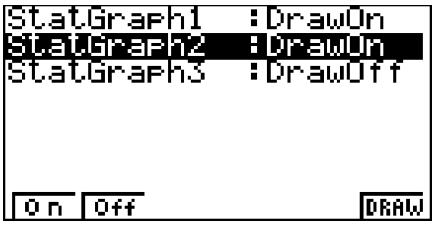
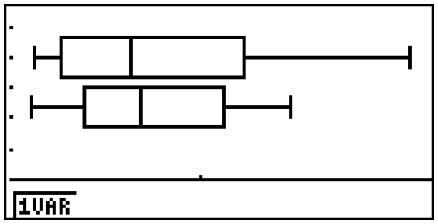
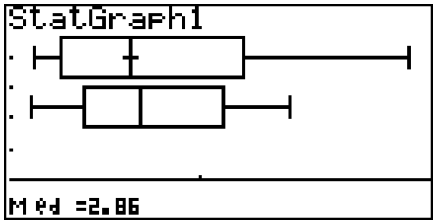
8. Press **EXIT**.
9. Press **F4(SEL)**, **F1(On)**, arrow down to StatGraph2 and press **F1(On)**, press **F6(DRAW)**.



10. Press **SHIFT**, **F1(Trace)** to find the median values on each graph. Press the left and right arrow keys to find the data on one graph and press the up and down arrow keys to switch graphs.





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Activity 3
The Years of Your Life

Teaching Notes

Topic Area: Linear Bivariate Data

NCTM Standards:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
  - Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable (9-12)
  - Understand histograms, parallel box plots, and scatterplots and use them to display data (9-12)
  - Compute basic statistics and understand the distinction between a statistic and a parameter (9-12)
- Select and use appropriate statistical methods to analyze data
  - Find, use, and interpret measures of center and spread, including mean and interquartile range (6-8)
  - For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools (9-12)

Objective

The student will be able to plot bivariate data in a scatterplot, make conjectures based on the plot, and create a regression equation using the graphing calculator.

Introduction

You can introduce this activity by asking your students some questions relating to their guess as to life expectancy. Ask them if they know the current life expectancy and what they think the trend has been over the last fifty years. Ask them to conjecture as to why they think the trend is there.

The students should be familiar with the following vocabulary:

Univariate	Interpolation
Regression	y-Intercept
Bivariate	Extrapolation
Trend	Slope

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator and a sample set of data that is included in the student pages. The students are using the sample data given to answer the questions.

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Name _____ Class _____ Date _____

Activity 3 • The Years of Your Life

Introduction

Over the past fifty years we have seen a trend in the life expectancy of humans. In this activity you will determine what that trend is and make a conjecture as to how long you think this trend will continue.

Problems and Questions

1. What is the relationship between the year and the life expectancy in years of a person?

   _____

   _____

2. In the year 2050 what would the life expectancy be if this trend continues?

   _____

   _____

3. In the year 1800 what was the life expectancy if this trend was seen at that time as well?

   _____

   _____

4. When would the life expectancy be zero? Is this likely?

   _____

   _____

5. Will this trend continue forever into the future? Why or why not?

   _____

   _____

   _____

   _____

   _____

Data:

Years	Life Expectancy (Years)
1900	47.3
1950	68.2
1960	69.7
1970	70.8
1975	72.6
1980	73.7
1981	74.1
1982	74.5
1983	74.6
1984	74.7
1985	74.7
1986	74.7
1987	74.9
1988	74.9
1989	75.1
1990	75.4
1991	75.5
1992	75.8
1993	75.5
1994	75.7
1995	75.8
1996	76.1
1997	76.5
1998	76.7
1999	76.7
2000	77.0
2001	77.2
2002	77.3

(from ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/Health_US/hus04tables/Table027.xls)

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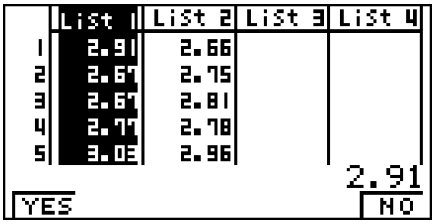
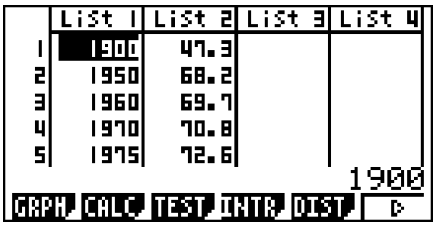
Solutions and Screen Shots for Activity 3

To find the relationship between year and life expectancy:

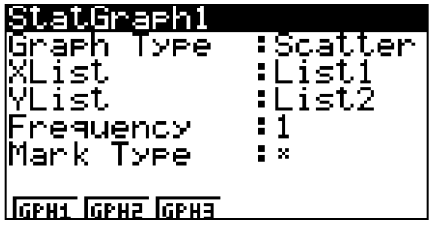
1. Delete any data that is currently in the lists.
   - Press the **AC/ON** button, from the main menu press **2(STAT)**.
   - If you have data in your lists, use the arrow keys to place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



2. Enter the Year data into List 1 and Life Expectancy data in List 2.
   - Enter data for Year into the first cell of List 1, **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Life Expectancy in List 2.



3. Press **F1(GRPH)**, **F6(SET)**. Make sure GraphType is Scatter by pressing down arrow, **F1(Scat)**, make sure XList is set to List 1 by pressing down arrow **F1(List1)**, and make sure that YList is set to List 2 by pressing down arrow **F2(List2)**. Press **EXIT**.



4. Press **EXE**.

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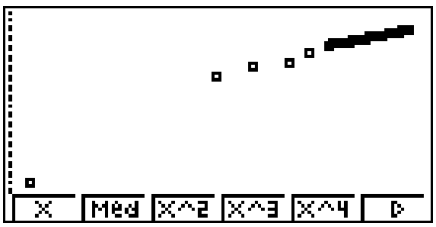
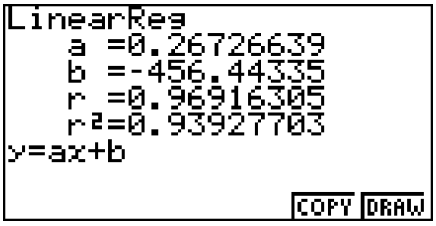
5. Press **F1(GPH1)**.

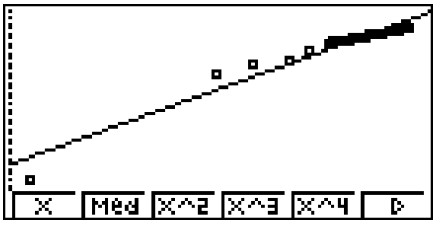


6. Press **F1(x)**.
   The regression equation should appear on the screen.



7. To save the regression equation for later data analysis, press **F5(COPY)**, **EXE**.

8. To see the regression equation drawn on the graph, press **F6(DRAW)**.



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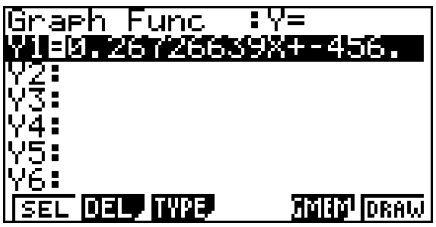
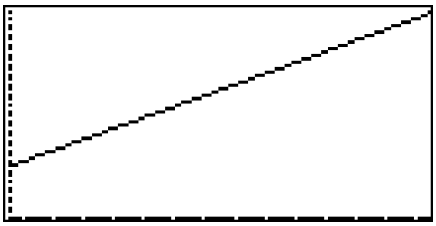
To find life expectancy in the year 1800 and the year 2050:

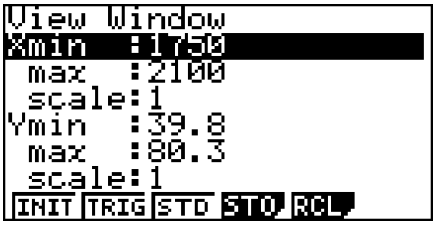
1. Press **EXIT**, **EXIT**.
2. Press **MENU**.
3. Use the arrow keys to highlight **GRAPH** and press **EXE**, or press **5**.
   The equation is stored in the graph function Y1.



4. Press **F6(DRAW)** to see the graph.



5. Set up the viewing window by pressing **SHIFT**, **F3(V-Window)**. Make sure the Xmin is set by typing **1750 EXE** and make sure the Xmax is set by typing **2100 EXE**.



6. Press **EXIT**.
7. Press **F6(Draw)**.

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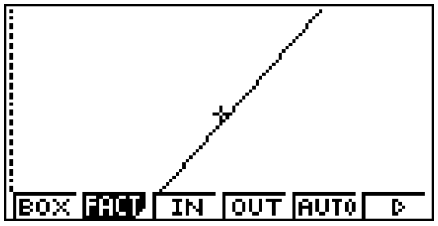
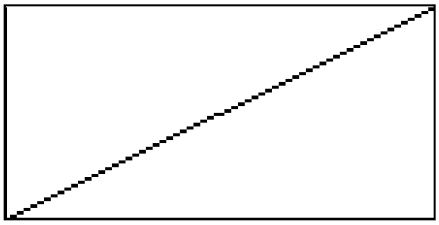
Solutions and Screen Shots for Activity 3
(continued)

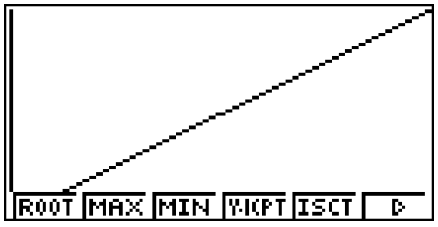
8. Press **SHIFT**, **F2(Zoom)**, **F5(AUTO)**.

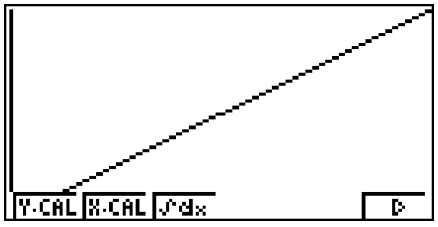


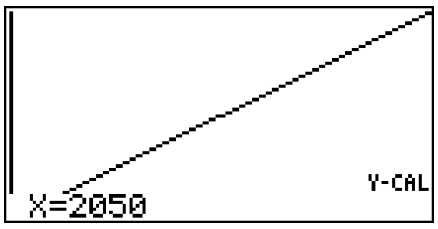


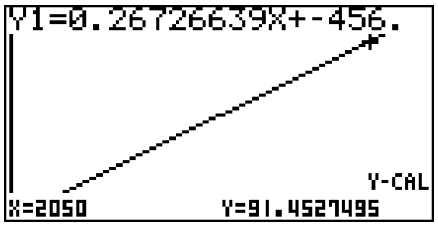
9. Press **SHIFT**, **F5(G-Solv)**.
10. Press **F6**, **F1(Y-CAL)**, **2050 EXE**.

    The solution should appear on the bottom of the screen.

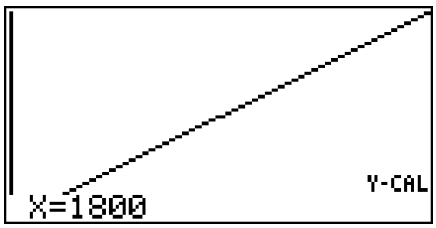


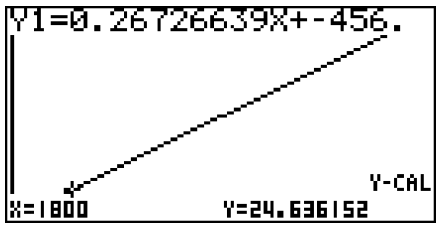






11. Repeat for the year 1800 as well.





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Activity 4
Spending Too Much

Teaching Notes

Topic Area: Non-linear Bivariate Data

NCTM Standards:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
  - Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable (9-12)
  - Understand histograms, parallel box plots, and scatterplots and use them to display data (9-12)
  - Compute basic statistics and understand the distinction between a statistic and a parameter (9-12)
- Select and use appropriate statistical methods to analyze data
  - Find, use, and interpret measures of center and spread, including mean and interquartile range (6-8)
  - For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools (9-12)

Objective

The student will be able to plot bivariate data in a scatterplot, make conjectures based on the plot, and create a regression equation using the graphing calculator.

Introduction

Introduce the problem to the students. This would be a good time to include some real life issues with money in college (i.e. credit cards, living expenses).

The students should be familiar with the following vocabulary:

Univariate	Bivariate
Regression	Trend
Interpolation	Extrapolation
y-Intercept	Slope
R, R^2 values	

The students are presented with an example that looks rather linear, but only after further investigation can the students determine that the exponential regression equation fits better ($R^2 = 0.9969$ for linear, $R^2 = 0.9999$ for exponential).

Getting Started

For this activity you will need the fx-9750G Plus graphing calculator and the sample set of data. The students are using the sample data given.

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Name _____ Class _____ Date _____

Activity 4 • Spending Too Much

Introduction

Sandy's parents loaned her some money for her to use during college. She noticed that she spent a certain percentage of that money each month. The chart below represents the amount of money left in Sandy's account at the end of the each month the first twenty months away from home.

Data:

Month	Money Left in Account
1	$5200.00
2	$5050.00
3	$4904.50
4	$4763.30
5	$4626.40
6	$4493.60
7	$4364.80
8	$4239.90
9	$4118.70
10	$4001.10
11	$3887.10
12	$3776.50
13	$3669.20
14	$3565.10
15	$3464.10
16	$3366.20
17	$3271.20
18	$3179.10
19	$3089.70
20	$3003.00

Problems and Questions

1. What regression equation best represents her spending?

   _____

2. Explain what the coefficients and other numbers in your equation mean.

   _____

   _____

   _____

   _____

   _____

3. How much money will she have in her account in 4 years, the estimated time she will be away at college?

   _____

4. Will she have enough money to make it through? Why or why not?

   _____

   _____

5. When will she run out of money according to the regression equation? Is this realistic? Why or why not?

   _____

   _____

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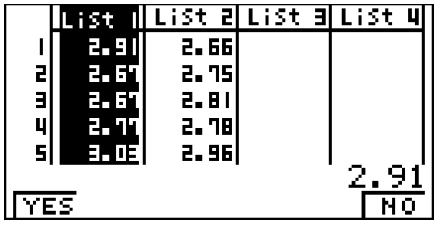
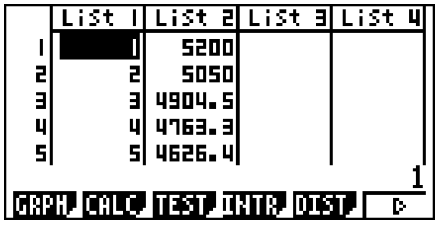
Solutions and Screen Shots for Activity 4

To find the relationship between month and money left in the account:

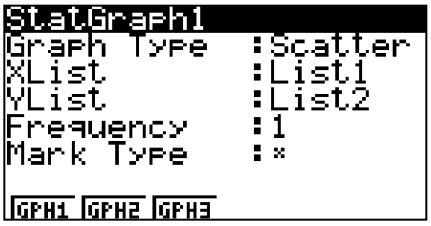
1. Delete any data that is currently in the lists.
   - Press the **AC/ON** button, from the main menu press **2(STAT)**.
   - If you have data in your lists, use the arrow keys to move the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



2. Enter the Month data into List 1 and Money Left in Account data in List 2.
   - Enter data for Month into the first cell of List 1, **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Money Left in Account in List 2.



3. Press **F1(GRPH)**, **F6(SET)**. Make sure GraphType is Scatter by pressing the down arrow key and **F1(Scat)**, make sure XList is set to List 1 by pressing the down arrow key and **F1(List1)**, and make sure that YList is set to List 2 by pressing the down arrow key and **F2(List2)**.



4. Press **EXE**.

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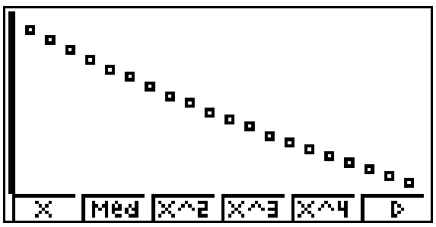
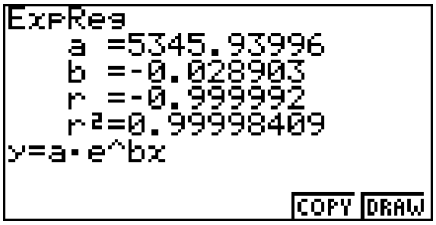
5. Press **F1(GPH1)**.

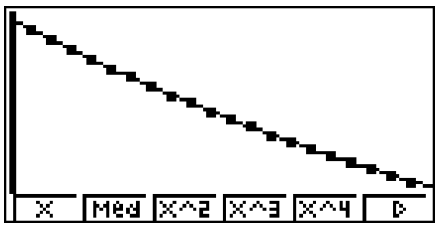


6. Press **F6** for more options, press **F2(Exp)**.
   The regression equation should appear on the screen



7. To save the regression equation for later data analysis, press **F5(COPY)**, **EXE**.

8. To see the regression equation drawn on the graph, press **F6(DRAW)**.



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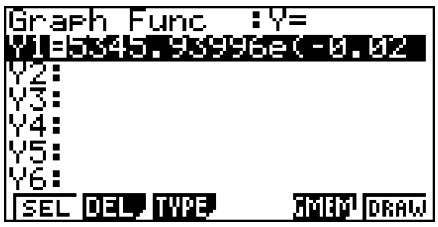
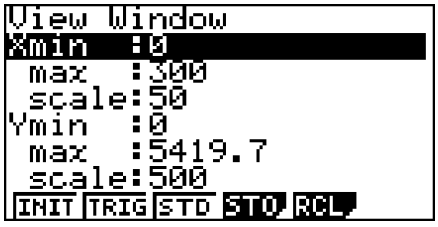
To find the money left in her account in four years and when she will run out of money:

1. Press **EXIT**, **EXIT**.
2. Press **MENU**.
3. Arrow over to highlight **GRAPH** and press **EXE**, or press **5**.

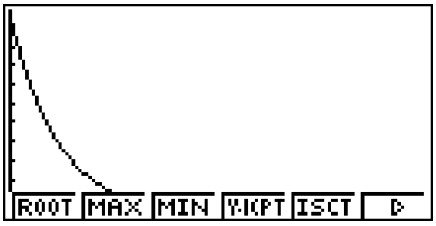
   The equation is stored in the graph function Y1.



4. Press **F6(DRAW)**.
5. Set up the viewing window by pressing **SHIFT**, **F3(V-Window)**. Make sure the Xmin is set by typing **0 EXE** and make sure the Xmax is set by typing **300 EXE**, make sure X scale is set by typing **50 EXE**, make sure that Ymin is set by typing **0 EXE**, make sure Y scale is set by typing **500 EXE** (leave Ymin and Ymax as they are by pressing the down arrow key to skip).



6. Press **EXIT**.
7. Press **F6(Draw)**.



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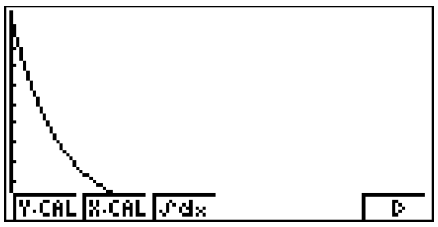
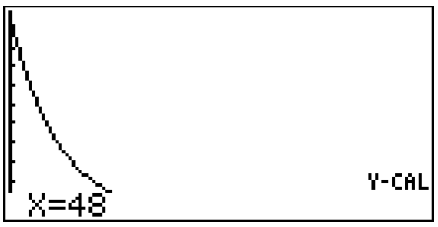
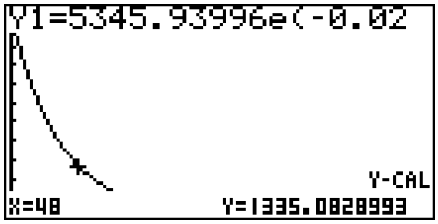
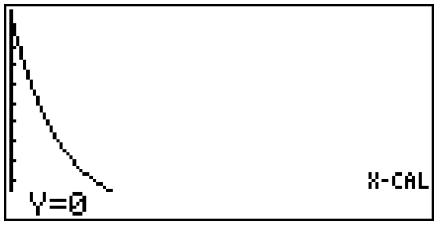
8. Press **SHIFT**, **F5(G-Solv)**.
9. Press **F6**, **F1(Y-CAL)**, **48 EXE**.
   The solution should appear on the bottom of the screen.

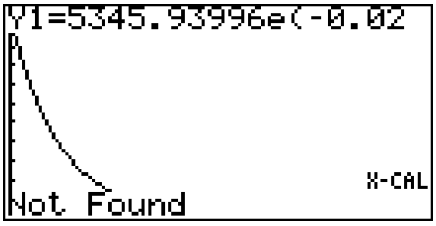






10. Press **SHIFT**, **F5(G-Solv)**.
11. Press **F6**, **F2(X-CAL)**, **0 EXE**.
    The solution should appear on the bottom of the screen.





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Activity 5
Ice Cream Favorites

Teaching Notes

Topic Area: Probability- Combinations

NCTM Standards:

- Understand and apply basic concepts of probability
  - Understand the concepts of conditional probability and independent events (9–12)
  - Understand how to compute the probability of a compound event (9–12)

Objective

The student will be able to determine the number of possible variations of flavors of an ice cream cone given different parameters.

Introduction

In this activity the students will learn how to use the graphing calculator to determine combinations of ice cream cone flavors. There will be three different calculations.

Use the following descriptions to go through the solutions manually:
The student is told that he/she has three different flavors to choose from and asked to find out how many different combinations of two flavors can be made. In order to do this, he/she needs to know the equation:

$$ {}_pC_k = \frac{P!}{K!\,(P-K)!} $$

P is the number of total choices the student has (in this case it would be the total number of ice cream flavors) and K is the number of choices the student has in his/her combination (in this case it would be 2, since he/she is looking for combinations of two flavors). The exclamation mark means that the number is a factorial.

$$ {}_pC_k = \frac{P!}{K!\,(P-K)!} = {}_3C_2 = \frac{3!}{2!\,(3-2)!} = \frac{6}{2} $$

$$ = 3 \text{ combinations} $$

Now the student is told that the ice cream store has added 5 new flavors, which means that the total number of flavors is now 8. They are asked to find out how many two flavor combinations there are now. The student should use the same equation as before, only this time P is 8 instead of three (because there are 8 total choices now).

$$ {}_pC_k = \frac{P!}{K!\,(P-K)!} = {}_8C_2 = \frac{8!}{2!\,(8-2)!} = \frac{40320}{1440} $$

$$ = 28 \text{ combinations} $$

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The last calculation changes the *P* and *K* values again. Now *P* becomes 31 and *K* becomes 3.

$$ {}_pC_k = \frac{P!}{K!\,(P-K)!} = {}_{31}C_3 = \frac{31!}{3!\,(31-3)!} = \frac{8.22 \times 10^{33}}{1.83 \times 10^{30}} $$

$$ = \mathbf{4495\ combinations} $$

The students should be familiar with the following vocabulary:
Combinations
Probability

Getting Started

In this activity the students will need their **Casio fx-9750G Plus** graphing calculator. You may want the students to calculate these answers themselves and then check with their calculator.

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Name _____ Class _____ Date _____

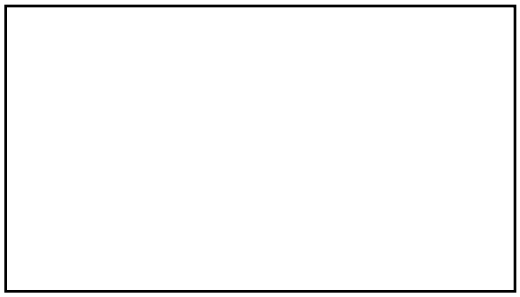
Activity 5 • Ice Cream Favorites

Introduction

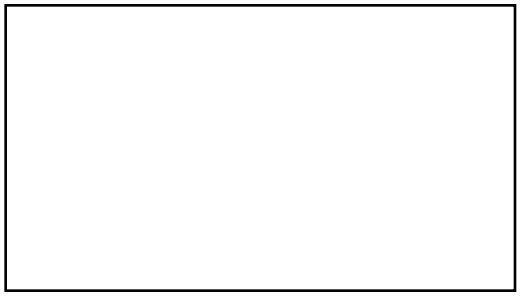
The local ice cream store has 31 flavors of ice cream. In this activity you will learn how to figure out how many combinations you can choose from for a 3-scoop ice cream cone.

Problems and Questions

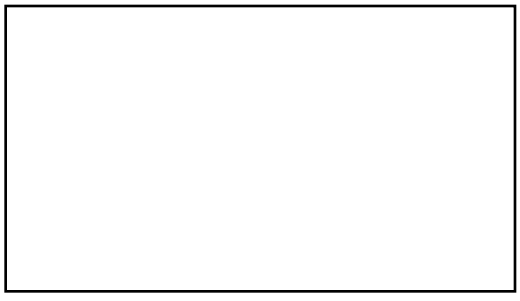
1. How many different two-flavor combinations would you have if there were only three flavors to choose from? _____
   Draw what you see in the box below.



2. If that ice cream shop added five new flavors to their list, how many different two-flavor combinations can they offer then? _____
   Draw what you see in the box below.



3. Now that ice cream shop has added an additional 23 flavors for a total of 31 flavors. You want three scoops of ice cream so you and a friend can share. How many three-flavor combinations do you have to choose from? _____
   Draw what you see in the box below.



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Solutions and Screen Shots for Activity 5

To find the combinations:

1. Press the **AC/ON** button from the main menu and press **1(RUN)**.
2. Type **3**, **OPTN**, **F6**, **F3(PROB)**, **F3(nCr)**, **2 EXE**.

Answer should appear on the right-hand side of the screen.

3. Type **8**, **F3(nCr)**, **2 EXE**.

Answer should appear on the right-hand side of the screen.

4. Type **31**, **F3(nCr)**, **3 EXE**.

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Activity 6
License Plate Numbers

Teaching Notes

Topic Area: Probability- Permutations

NCTM Standards:

- Understand and apply basic concepts of probability
  - Understand the concepts of conditional probability and independent events (9–12)
  - Understand how to compute the probability of a compound event (9–12)

Objective

The student will be able to determine the number of possible variations of license plate numbers in their state.

Introduction

In this activity the students will learn how to use the graphing calculator to determine permutations of license plate numbers. They will determine the number of license plate numbers in your state (or various states).

Use the following descriptions to go through the solutions manually:
The student is asked to find the number of permutations in the seven-place standard issue license plate in Virginia. In this case, placement is important so the student will use the permutations equation:

$$ {}_nP_k = \frac{n!}{(n-k)!} $$

n is the number of total choices the student has (in this case it would be the total number of choices the student has in terms of letters for the first three places or 26) and k is the number of choices the student has (in this case it would be 3, since he/she is looking for three letters). The exclamation mark means that the number is a factorial.

$$ {}_nP_k = \frac{n!}{(n-k)!} = {}_{26}P_3 = \frac{26!}{(26-3)!} = \frac{4.03 \times 10^{26}}{2.58 \times 10^{22}} = 15600 $$

$$ = 15600 \text{ permutations} $$

Now the student is told that the vanity or specialty plates can have numbers or letters in any of the seven places, which means that the total number of possible choices for each place is 36 (26 letters and 10 numbers). They are asked to find out how many seven place permutations there are now. The student should use the same equation as before, only this time n is 36 instead of 26 and k is 7 instead of 3.

$$ {}_nP_k = \frac{n!}{(n-k)!} = {}_{36}P_7 = \frac{36!}{(36-7)!} = \frac{3.71 \times 10^{41}}{8.84 \times 10^{30}} = 4.20 \times 10^{10} $$

$$ = 4.20 \times 10^{10} \text{ permutations} $$

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The last calculations change the n and k values again. The first questions changes the k value to 6 and then the second question changes the k value to 8, the n value remains the same in both cases. They will repeat the above calculations.

The students should be familiar with the following vocabulary:
Probability
Permutations

Getting Started

In this activity the students will need their **Casio fx-9750G Plus** graphing calculator. You may want the students to calculate these answers themselves and then check with their calculator.

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Name _____ Class _____ Date _____

Activity 6 • License Plate Numbers

Introduction

The state of Virginia has a total of seven places available for numbers and letters on its license plate. Usually the first three are letters and the second four are numbers, but they are not necessarily set, especially if you purchase specialty license plates.

Problems and Questions

1. How many different permutations are available on the standard issue Virginia license plate (those that have three letters first and four numbers second)?

   _____

2. How many different permutations are available if you can have any combination of numbers and letters in those seven places?

   _____

3. How many more do they have now than they had when they only had six places on the plate?

   _____

   How many more would they have if they could fit another place on the plate?

   _____

4. How many permutations does your state have on its standard issue license plate?

   _____

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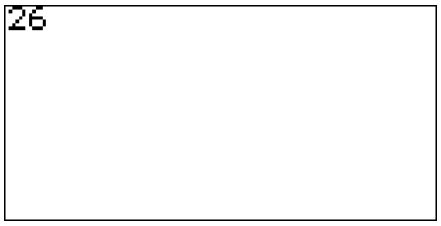
Solutions and Screen Shots for Activity 6

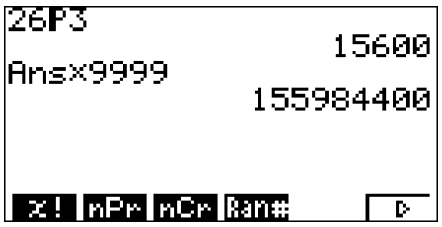
To find the permutations:

1. Press the **AC/ON** button and press **1(RUN)**.

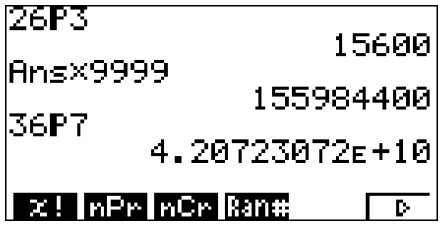
   Type **26**, **OPTN**, **F6**, **F3(PROB)**, **F2(nPr)**, **3**, **EXE**. Answer should appear on the right-hand side of the screen.



2. Type **x 9999 EXE**. Answer should appear on the right-hand side of screen.



3. Type **36**, **F2(nPr)**, **7 EXE** Answer should appear on the right-hand side of the screen.



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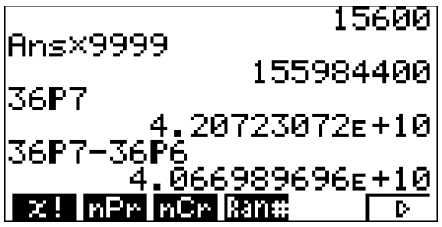
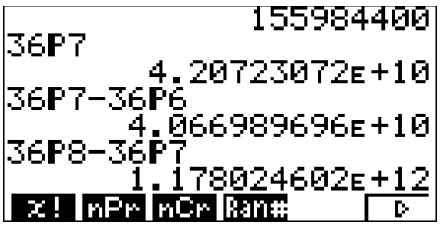
4. Type **36**, **F2(nPr)**, **7 – 36**, **F2(nPr)**, **6**, **EXE**.
   Answer should appear on the right-hand side of the screen.



5. Type **36**, **F2(nPr)**, **8 – 36**, **F2(nPr)**, **7**, **EXE**.
   Answer should appear on the right-hand side of the screen.



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Activity 7
What Color is Your Car?

Teaching Notes

Topic Area: Random Sampling, Categorical Data

NCTM Standards:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
  - Understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each (9-12)
  - Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and the term variable (9-12)
- Select and use appropriate statistical methods to analyze data
  - Display and discuss bivariate data where at least one variable is categorical (9-12)
- Develop and evaluate inferences and predictions that are based on data
  - Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions (9-12)
  - Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference (9-12)

Objective

Students will be able to create a frequency table of a random sample of car colors in categories and create a histogram representation of the data.

Introduction

You may want to use the following statistical information to peak your student's interest in this activity. You can also personalize this information to your particular state by doing a search on the Internet for Car Sales Statistics.

"In the year 2004, consumers in the state of Maryland spent over $16 billion in buying motor vehicles. Can you imagine how much the entire United States spent? According to JD Power and Associates fourth-quarter sales in 2004, silver was the most popular car color to purchase, with almost 1/4 of the cars sold in that quarter being silver. What do you think is the next biggest seller? Black—at 16 %!

The students should be familiar with the following vocabulary:
Categorical data Sampling Frequency Histogram

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator and access to a large parking area in your school or community. The students should collect color data from the cars in the parking lot. Have them count how many cars in the parking lot are each color You may want the students to break up the parking lot into sections and share the data once the entire parking lot has been counted.

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Name _____ Class _____ Date _____

Activity 7 • What Color is Your Car?

Introduction

Find a partner to do this activity with. Go to the parking lot of your school or community and record the colors and the numbers of cars of each color there are. Follow your teacher's instructions for the data collection. Create a table with color categories in the first column and the number of cars in the second column. Use the data to answer the following questions.

Problems and Questions

1. What is the most popular car color in your school or community (a sample of the whole population)?

   _____

   What percent of the total number of cars was this color?

   _____

2. Create a histogram for the data you collected and draw it in the box below.

   How did you go about categorizing the colors in the histogram? Why did you do it this way?

   _____

   _____

3. Based on your information, what colors do you think the next 50 cars will be?

   _____

   _____

4. Based on JD Power and Associates data for the year 2004 fourth-quarter sales, 24.1% of the cars bought were silver. Do your results match this result? Make a conjecture as to why your data did or did not match the data from JD Power and Associates.

   _____

   _____

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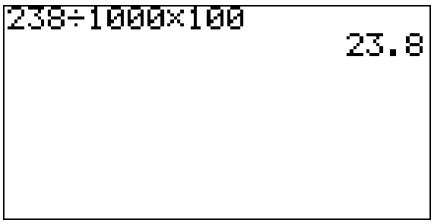
Solutions and Screen Shots for Activity 7

Color	Number of Cars
Silver	238
Black	167
Blue	132
White	120
Grey	103
Red	101
Green	58
Beige	45
Gold	27
Brown	9
Total	1000

To find the most popular car and the percentage of the total number of cars:

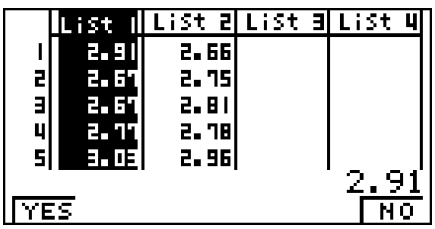
1. From the Main Menu (if it is not showing, press **MENU** button) press **1** for RUN.

2. Type **238 ÷ 1000 × 100 EXE**. The answer should appear on the right hand side of the screen.



To create a histogram:

1. Delete any data that is currently in the lists.
   - Press the **AC/ON** button, from the main menu press **2(STAT)**.
   - If you have data in your lists, place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



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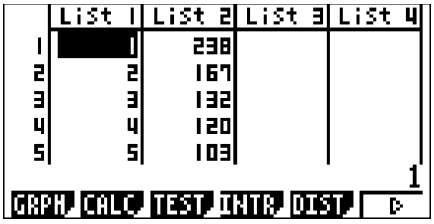
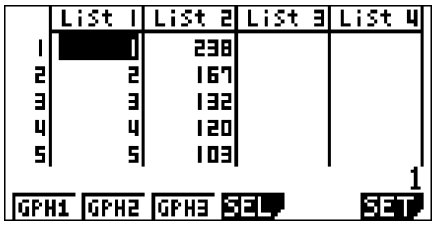
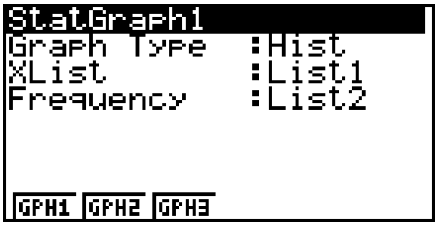
Solutions and Screen Shots for Activity 7
(continued)

2. Enter the Color Number data into List 1 and Number of Cars data in List 2.
   - Enter data for Color Number into the first cell of List 1, **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Number of Cars in List 2.

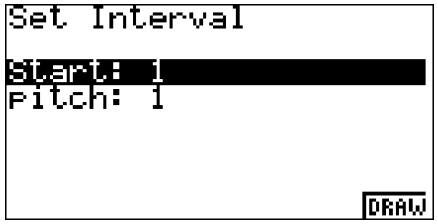


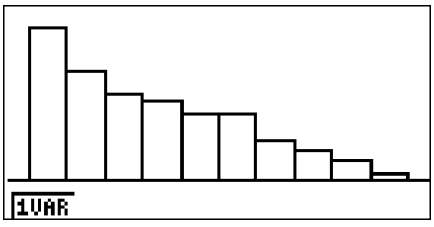
3. Press **F1(GRPH)**, **F6(SET)**. Make sure GraphType is Histogram by pressing down arrow **F6** for more options and **F1(Hist)**, make sure XList is set to List 1 by pressing down arrow **F(List1)**, and make sure that Frequency is set to List 2 by pressing down arrow **F3(List2)**. Press **EXIT**.





4. Press **F1(GPH1)**, then **F6** to draw the graph.





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Activity 8
Grade Distribution

Teaching Notes

Topic Area: Normal Probability

NCTM Standards:

- Develop and evaluate inferences and predictions that are based on data
  - Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions (9-12)
  - Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference (9-12)

Objective

The students will be able to determine if a set of data is normal and determine the skew of the data using a normal probability plot.

Introduction

The students will use sample end of the year grade data to explore normal probability in a histogram and normal probability plot. If your students do not have experience with normal probability plots, you may want to review with them that it will be linear if the data is normal. If it is not normal and it is skewed to one side, the data will show a steeper slope either above or below the axis. If the steeper slope is below the axis, it is right-skewed, and if it is above the axis, it is left-skewed.

The students should be familiar with the following vocabulary:
Sample
Histogram
Normal probability
Normal probability plot
Conjecture
Population

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator and the sample set of data. The students are using the sample data given.

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Name _____ Class _____ Date _____

Activity 8 • Grade Distribution

Introduction

The data represents two different years of one teacher's end of the year course grades. Using that data, answer the following questions:

	Data Set 1	Data Set 2
1		0
2	0 3	
3		5
4	1 3	
5	2 3 3 7 9	2 3
6	0 0 1 1 2 5 5 5 9	
7	1 2 3 4 5 5 7 8	0 2 3 5 6 7 7 8 9
8	1 1 5 5 5 8 8 9 9	0 0 0 1 2 2 2 3 3 4 4 5 5 5 5 6 7 7 7 8 8 8 8 9 9
9	3 4 5 8	0 1 1 2 2 2 2 3 3 4 4 4 4 6 6 6 7 7 7 8
10	0	0 0 0 0 0

Problems and Questions

1. Draw a histogram for each set of data.

Set 1

Set 2

According to the histograms for the two sets of data, are they normally distributed? Why or why not?

_____

_____

_____

_____

_____

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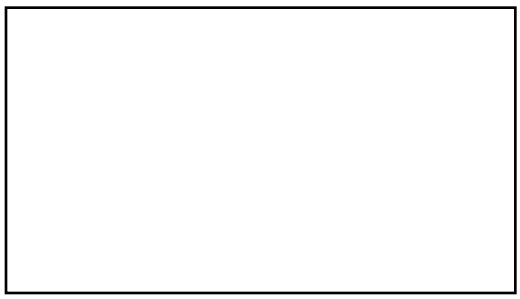
Name _____ Class _____ Date _____

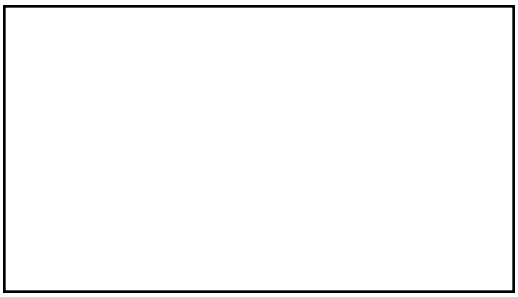
Activity 8 • Grade Distribution (continued)

2. Create and draw the normal probability plot for each set of data.

Set 1



Set 2



What does the normal probability plot tell you about the data? Does this support your answer from number 1? Why or why not?

_____

_____

_____

_____

_____

_____

3. If you were to make a conjecture based on this sample data (set 1) as to how future students would do in the class, what would you say?

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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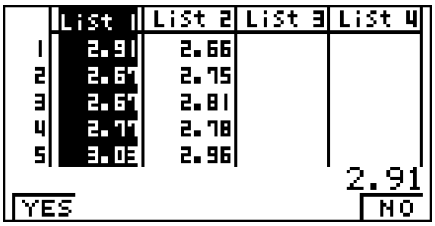
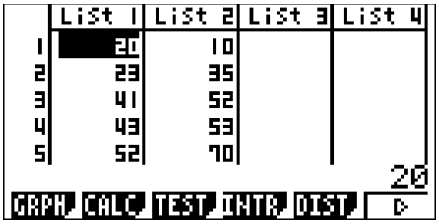
Solutions and Screen Shots for Activity 8

To plot histograms:

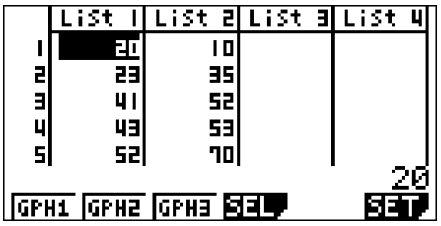
1. Delete any data that is currently in the lists.
   - Press the **AC/ON** button, from the main menu press **2(STAT)**.
   - If you have data in your lists, place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.

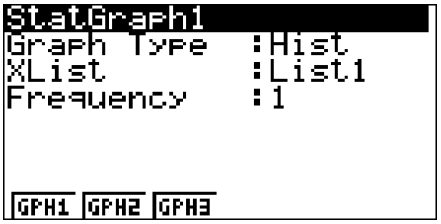


2. Enter the Set 1 data into List 1 and Set 2 in List 2.
   - Enter data for Set 1 into the first cell of List 1, press **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Set 2 in List 2.

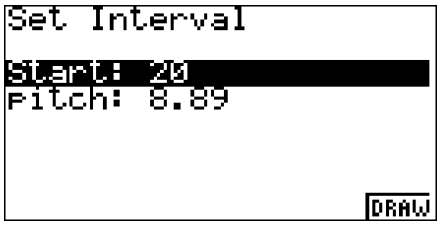


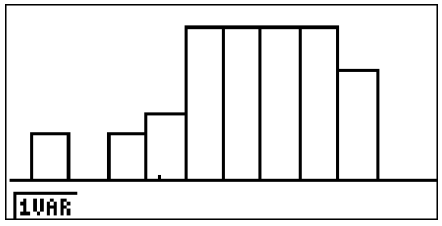
3. Press **F1(GRPH)**, **F6(SET)**. Make sure GraphType is Histogram by pressing down arrow **F6** for more options and **F1(Hist)**, make sure XList is set to List 1 by pressing down arrow **F1(List1)**, and make sure that Frequency is set to 1 by pressing **F1**. Press **EXIT**.



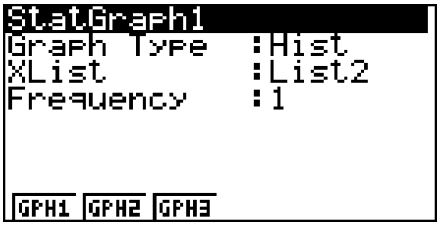


4. Press **F1(GPH1)**, then **F6(DRAW)**.





5. Press **EXIT**, **F6(SET)**. Make sure XList is set to List 2 by pressing down arrow **F2 (List2)**. Press **EXIT**.



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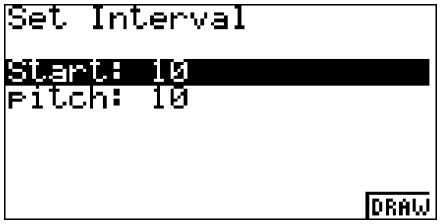
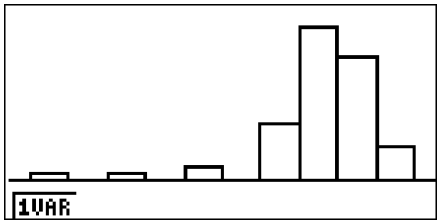
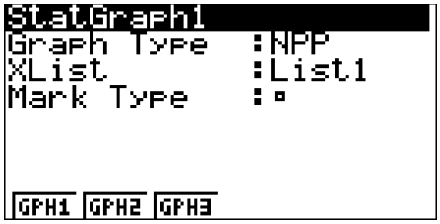
6. Press **F1(GRH1)**, then **F6** to draw the graph.



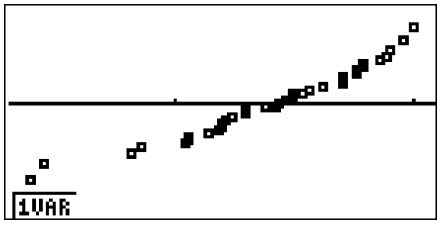


To plot normal probability plots:

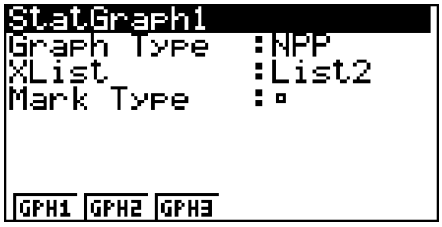
1. Press **EXIT**, **F6(SET)**. Make sure GraphType is Normal Probability Plot by pressing down arrow **F3(NPP)**, make sure XList is set to List 1 by pressing down arrow **F1(List1)**. Press **EXIT**.



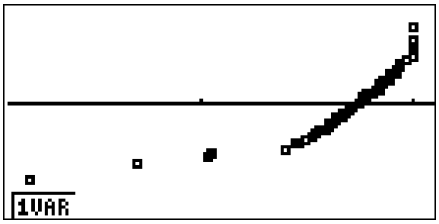
2. Press **F1(GPH1)**, then **F6** to draw the graph.



3. Press **EXIT**, **F6(SET)**. Make sure XList is set to List 2 by pressing down arrow **F2(List2)**. Press **EXIT**.



4. Press **F1(GPH1)**, then **F6** to draw the graph.



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Activity 9
Rainbow of Fruit Flavors

Teaching Notes

Topic Area: Hypothesis Testing

NCTM Standards:

- Develop and evaluate inferences and predictions that are based on data
  - Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions (9-12)
  - Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference (9-12)

Objective

The students will be able to accept or reject a null hypothesis based on given data and calculations of confidence.

Introduction

This activity should work well with the students because they get to have candy. Only one rule: they have to count before they eat!

The students will need their own personal data as well as a full class set of data. Have each student open their bag of Skittles®, count and record the number of each color they have in a chart. After each student has finished counting, have he/she share the data with the class. Make a class chart on the overhead, board, or flip chart. Have them follow the directions on the student worksheet to complete the activity.

The students should be familiar with the following vocabulary:

Sample	Sample distribution
Population	Mean
Parameters	Inference
Confidence	Z-test
Variables: Z, p, n	

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator and small bag of Skittles®. The students will perform a confidence test based on the percentage of one color in the bag compared to the class percentage of the same color.

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Name _____ Class _____ Date _____

Activity 9 • Rainbow of Fruit Flavors

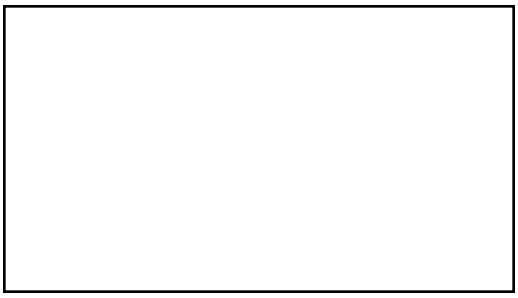
Introduction

Open your bag of Skittles® and count the number of each color that is in the bag. Record those numbers in the first row of the chart below. Share your sample information with the class and record the total number of each color in the entire class in the second row of the chart (include your data in the class data row also).

Red	Orange	Yellow	Green	Blue	Purple	TOTAL

Problems and Questions

1. If you had to choose one color, which would you choose? _____
2. What percent of the total is that color in your bag? _____
3. What percent of the total is that color in the class data? _____
4. Create a null hypothesis by filling in the blanks below:
   a. **Null Hypothesis:** My sample bag of _____ percent of _____ color came from the same population as the class set of _____ percent of _____ color.
5. Perform a 1-prop Z-test of population proportion to test the null hypothesis.
   a. What is the Z value? _____
   b. What is the p value? _____
   c. Is this p value high or low? _____
   d. Draw the proportion graph in the box below.



6. Can you reject the null hypothesis? Why or why not?

_____

_____

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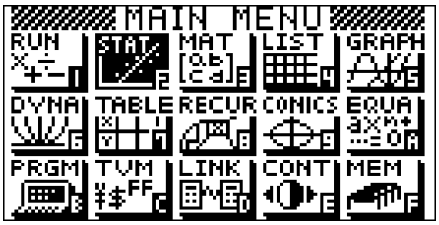
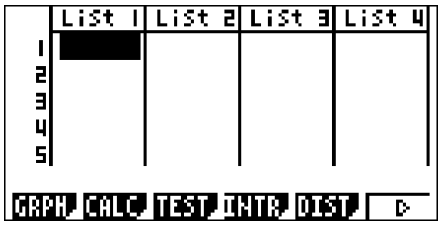
Solutions and Screen Shots for Activity 9

To perform the 1-prop Z-test:

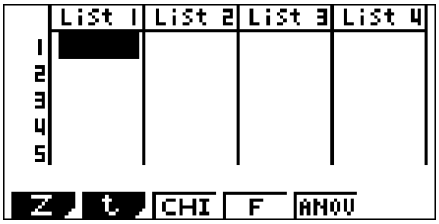
1. Press the **AC/ON** button, from the main menu press **2(STAT)**.



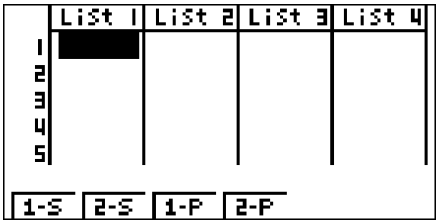
2. Press **F3(TEST)**.



3. Press **F1**(Z).



4. Press **F3(1-P)**.



5. Highlight *Prop* and press **F1(≠)**.
6. Highlight *p0* and type the class data percentage for that color.
7. Highlight *x* and type in the number of that color from the sample bag.

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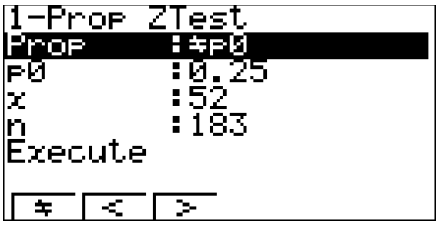
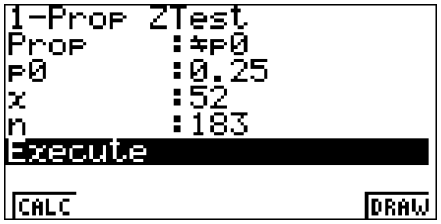
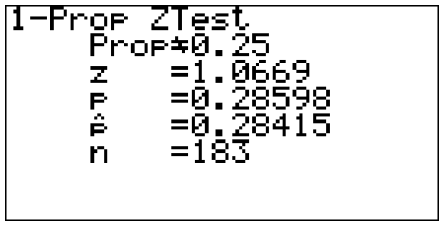
8. Highlight *n* and type in the total of that color in the class data.

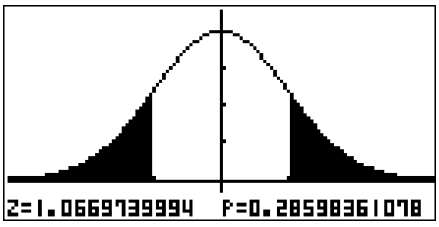


9. Highlight Execute and press **F1(CALC)**.





10. Press **EXIT** and highlight Execute and press **F6(DRAW)**.



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Activity 10
Class Height

Teaching Notes

Topic Area: Confidence Intervals

NCTM Standards:

- Develop and evaluate inferences and predictions that are based on data
  - Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions (9-12)
  - Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference (9-12)

Objective

The students will be able to calculate the confidence interval for the height of the students in their class.

Introduction

Showing students why it is important to be able to calculate confidence intervals may be difficult. This activity is chosen for its ease of data collection so that the students can concentrate on the statistics.

Use the following descriptions to go through the solutions manually:
There are two types of confidence interval tests that you can perform with data: t-test and z-test. The t-test is performed when the mean ($\overline{X}$) and standard deviation (s) for sample are known but not for the entire population. The standard deviation of the population is estimated based on the number of degrees of freedom ($df = n - 1$). The z-test requires both the mean and standard deviation for the sample and population. In this activity, the students will assume the mean of the population is the same as the sample and will not know the standard deviation for the population, thus they will be doing a t-test.

If a student wants to compare a sample population to an entire population, the student may use a t-test. There are two types of t-tests: one-tailed and two-tailed. A one-tailed test would be used if the student wanted to know if the mean of the sample were larger than the mean of the population or if the sample mean were smaller than the mean of the population. A two-tailed test would show if the mean of the sample were smaller or larger than the mean of the population. With a certain degrees of freedom value for a particular sample, the confidence value would determine how sure the results were. For example, if you wanted to be 99% sure that your hypothesis was correct, you would go with a confidence of $p = 0.01$ for a one-tailed test or $p = 0.005$ for a two-tailed test. The t-value must be found using a table of values based on degrees of freedom and the confidence value. There are also many t-value calculators on the Internet. In this activity, the students will perform a two-tailed test.

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The t-test calculation is shown below:

$t = \frac{\bar{X} - \mu}{s/\sqrt{n}}$ where $\bar{X}$ is the mean of the sample, μ is the mean of the population, s is the standard deviation of the sample, and n is the number of values in the sample. The confidence interval can be calculated using the following formula: $\bar{X} \pm [t \bullet s/\sqrt{n}]$

The students should be familiar with the following vocabulary:

Mean	Standard deviation
Degrees of freedom	Confidence
T-test	Z-test
Population	Sample

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator, measuring tapes (at least 2 meters), and a class chart with a column for height in centimeters. You may want the students to calculate these values themselves and then check with the calculator.

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Name _____ Class _____ Date _____

Activity 10 • Class Height

Introduction

Your classmate heard that there will be an additional student in your math class next week. She is curious to see whether or not that student's height will fall within a 95% confidence interval for the current students in her class.

Problems and Questions

1. How many students do you have in your class today?

_____

2. What is the degrees of freedom value for the *n*-value in number one?

_____

3. For the 95% confidence interval, what would the p-value be?

_____

4. What is the mean height of all the students in your class today?

_____

5. What is the standard deviation of the height?

_____

6. Assuming the mean of the population is the same as the sample, what is the 95% confidence interval for the height of students?

_____

7. If the new student's height was 172 centimeters, would he fall into that 95% confidence interval? What about a 99% confidence interval? Is there a difference? Why or why not?

_____

_____

_____

_____

Height in centimeters

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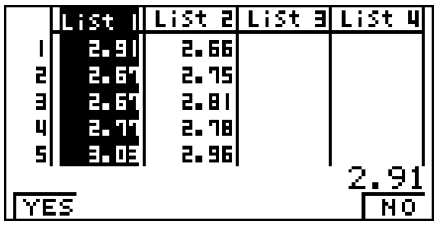
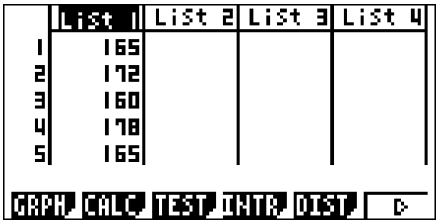
Solutions and Screen Shots for Activity 10

To find the 95% confidence interval:

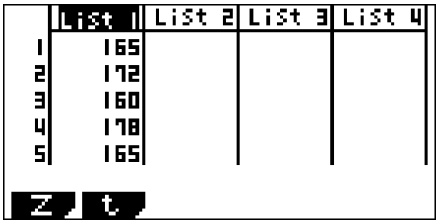
1. Delete any data that is currently in the lists.
   - Press the **AC/ON** button, from the main menu press **2(STAT)**.
   - If you have data in your lists, place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



2. Enter the Height data into List 1.
   - Enter data for height into the first cell of list 1, press **EXE**.
   - Repeat until all data are entered into List 1.



3. Find the *t*-interval at 95% confidence:
   - Press **F4(INTR)**.
   - Press **F2(*t*)**.



Height in centimeters
165
172
160
178
165
169
174
155
164
179
167
172
159
172
164
167
180
145
176
166

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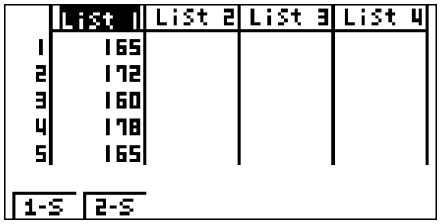
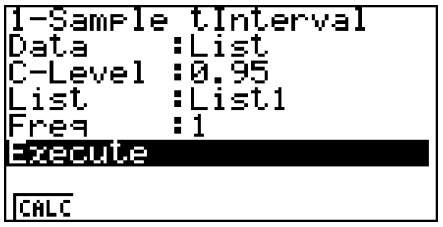
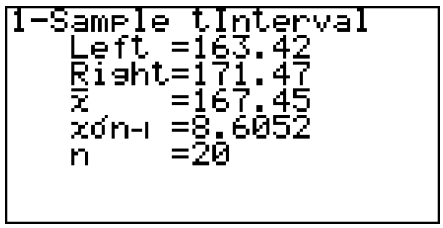
- Press **F1(1-S)** (one sample).



- With Data highlighted, press **F1(List)**.
- With C-level highlighted, type **0.95 EXE**.
- With List highlighted, press **F1(List 1)**.
- With Execute highlighted, press **F1(CALC)**.



The following values will show up on the screen:



Left:	the minimum value in the interval
Right:	the maximum value in the interval
$\bar{x}$:	the mean of sample
$\bar{x}\sigma_{n-1}$:	the standard deviation of sample
n:	the number in the sample

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Activity 11
Exit Polls

Teaching Notes

Topic Area: Hypothesis Tests—Chi-square, Two-way Tables

NCTM Standards:

- Develop and evaluate inferences and predictions that are based on data
  - Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions (9-12)
  - Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference (9-12)

Objective

The students will be able to support or reject a null hypothesis based on given data and calculations of confidence using a Chi-square distribution.

Introduction

The Chi-squared test is used to figure out if the rows of a set of data are contingent upon the columns in that same set of data, or a test of independence. In this activity, the students are presented with a set of "exit poll" data showing the number of votes for three different candidates at the sophomore, junior, and senior level. The data was taken by a random poll of students after the vote. The null hypothesis in this case states that the class level is independent of the candidate voted for. If this null hypothesis is rejected, the students could say that there was a difference in candidate preference between the three classes of students.

Use the following descriptions to go through the chi-square test manually:
In order to calculate the chi-square test, the student needs to calculate the row and column totals and calculate the expected cell frequencies using the equation:

$$E_{cell1,A} = \frac{T_1 - T_A}{N}$$

where $E_{cell1,A}$ is the expected frequency for the cell in the first column and the first row, T is the total number in the row or column, and N is the total number in the entire table.

	Candidate 1	Candidate 2	Candidate 3	Total
Sophomore	35 (30.449)	33 (31.058)	20 (26.491)	88
Junior	40 (35.986)	38 (36.705)	26 (31.307)	104
Senior	25 (33.564)	31 (34.235)	41 (29.2)	97
Total	100	102	87	289

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The next step in the Chi-square calculation is the computation of the Chi-square value:

$$\chi^2 = \sum \frac{(E - O^2)}{E}$$

where E is the expected value, O is the observed value. The comparison chi-square value must be found using a table of values based on degrees of freedom and the confidence value. There are also many chi-square value calculators on the Internet. The degrees of freedom are calculated by the number of rows minus one times the number of columns minus one, $df = (R-1)(C-1)$. The degrees of freedom value for this activity is four. If the confidence value is $p = 0.01$, the calculated chi-square value must at least 13.2767. The calculated chi-square value is 11.043 which is only significant to the $p = 0.026$. If the $p = 0.01$ parameter is set, the student cannot reject the null hypothesis, therefore the candidate chosen is independent of the class of the student.

Another example of when chi-square tests are used is when the results of a drug are compared against the results of a placebo.

The students should be familiar with the following vocabulary:

Mean	Standard deviation
Degrees of freedom	Confidence
Population	Sample
Chi-square test	

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator and the sample set of data. You may want the students to calculate these values themselves and then check with the calculator.

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Name _____ Class _____ Date _____

Activity 11 • Exit Polls

Introduction

Three candidates were running for student council president. After the vote, random students from each class were asked who they voted for. The results are shown in the table below:

	Candidate 1	Candidate 2	Candidate 3
Sophomore	35	33	20
Junior	40	38	26
Senior	25	31	41

Problems and Questions

1. What is the total number of votes for each candidate?

_____

_____

_____

2. What is the total number of polled voters in each class?

_____

_____

_____

3. What are the expected frequencies?

_____

_____

_____

4. Does the candidate chosen depend on the class of the student? How do you know?

_____

_____

_____

_____

_____

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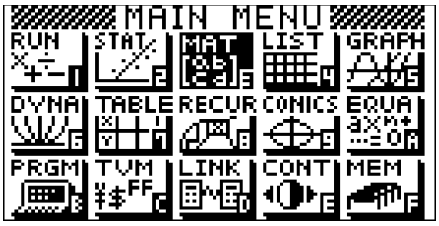
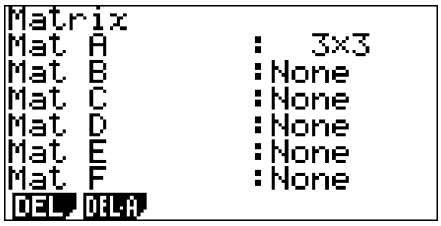
Solutions and Screen Shots for Activity 11

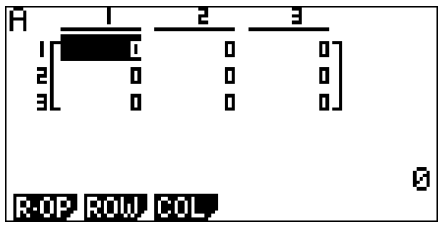
To find the Chi-square value:

1. Enter the data into a matrix.
   - Press the **AC/ON** button, from the main menu press **3(MAT)**.

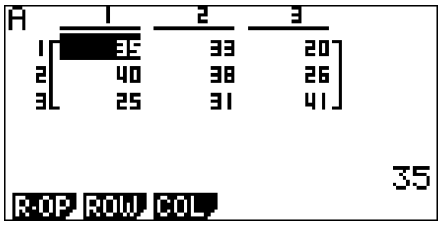


   - With *Mat A* highlighted, type **3 EXE**, **3 EXE**.





   - Enter data for sophomore, candidate 1 into the first cell, **EXE**.
   - Repeat until all data are entered into matrix (enter across then down).



   - Press **EXIT** then **MENU**.

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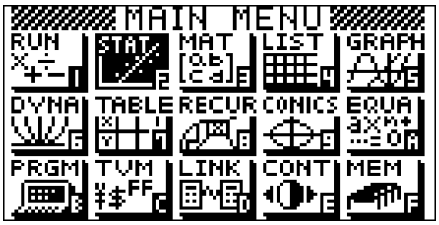
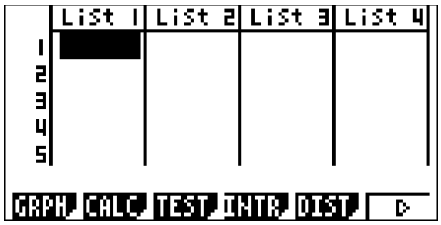
Find the Chi-square value for *Mat A:*

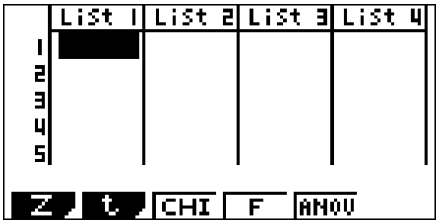
1. Press **2(STAT)**.



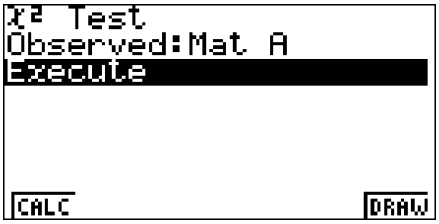
2. Press **F3(TEST)** (it does not matter if there is data in the lists).



3. Press **F3(CHI)**.



- With Observed highlighted, press **F1(A).**
- With Execute highlighted, press **F1(CALC).**



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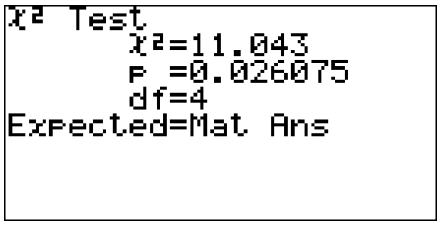
Solutions and Screen Shots for Activity 11
(continued)

The answers will appear on the screen:

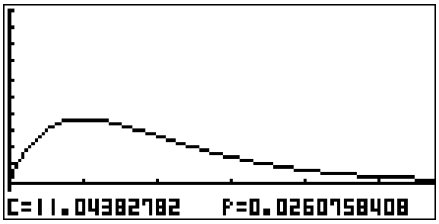


x^2:	chi-square value
p:	probability value
df:	degrees of freedom value
Expected:	Expected values are in an answer matrix

Show the graph of the probability value:

1. Press **EXIT**.
2. Highlight Execute and press **F6(DRAW)**.

The graph will appear on the screen.



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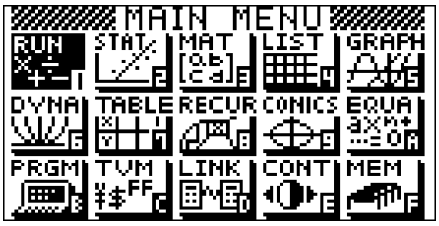
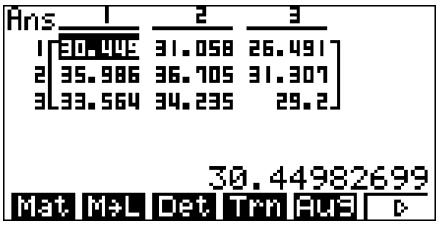
To view the answer matrix:

1. Press **EXIT** then **MENU**.



2. Press **1(RUN)**.
3. Press **OPTN**, **F2(MAT)**, **F1(Mat)**, **SHIFT**, **(-)(Ans)**, **EXE**.

The answer matrix will appear on the screen.



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Activity 12
IQ Testing

Teaching Notes

Topic Area: Normal Distribution Calculations

NCTM Standards:

- Understand and apply basic concepts of probability:
  - understand the concepts of sample space and probability distribution and construct sample spaces and distributions in simple cases (9-12)
  - use simulations to construct empirical probability distributions (9-12)
  - compute and interpret the expected value of random variables in simple cases (9-12)

Objective

The students will be able to calculate percentiles, ranges, and outliers for a set of normally distributed data.

Introduction

The normal curve or "bell curve" is helpful in analyzing many types of data. The normal distribution makes several assumptions. The data is:

- continuous
- symmetric around its mean
- bell-shaped
- mean equals the mode and the median

In this activity the students will explore the cumulative density function and the inverse cumulative density functions for normally distributed data.

The students should be familiar with the following vocabulary:

mean	standard deviation
population	sample
outliers	percentile
normal distribution	cumulative density function
inverse density function	

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator. If your students are calculus level or above, you may want the students to calculate these values themselves and then check with the calculator.

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Name _____ Class _____ Date _____

Activity 12 • IQ Testing

Introduction

The Intelligence Quotient test measures a person's intellectual age versus their actual age. The scores reported from IQ tests are distributed normally. The mean is 100 and the standard deviation is 15.

Problems and Questions

1. What percent of the population has a score above 125?

   _____

2. What percent of the population has a score below 75?

   _____

3. What percent of the population has a score between 115 and 150?

   _____

4. What IQ score would you need to be placed in the 96th percentile?

   _____

5. What IQ score would you need to be placed in the 99th percentile?

   _____

6. What would the IQ scores of any outliers be? Explain.

   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____
   _____

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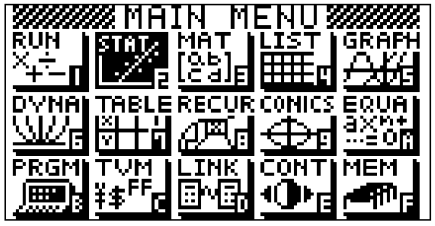
Solutions and Screen Shots for Activity 12

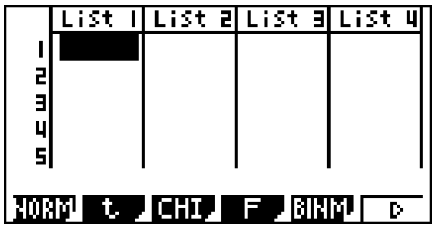
To find the normal cumulative density function for "above":

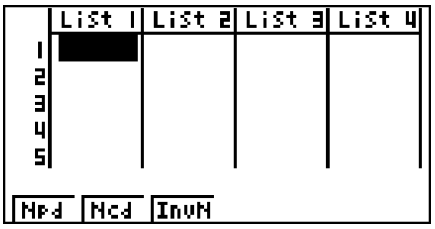
1. Press the **AC/ON** button and press **2(STAT)**.



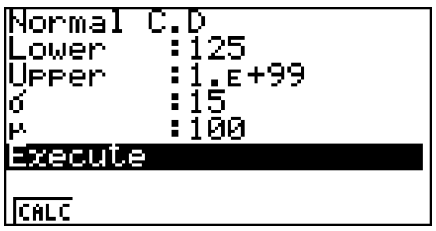
2. Press **F5(DIST)**.

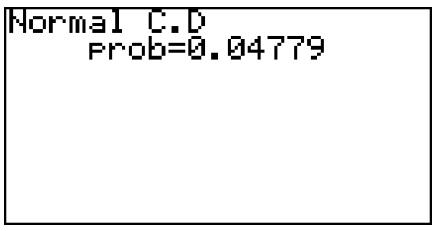
3. Press **F1(NORM)**.





4. Press **F2(NCD)**.
   - With Lower highlighted type **125 EXE**.
   - With Upper highlighted type **1 EXP 99 EXE**.
   - With σ highlighted type **15 EXE**.
   - With μ highlighted type **100 EXE**.
   - With Execute highlighted press **F1(CALC)**.





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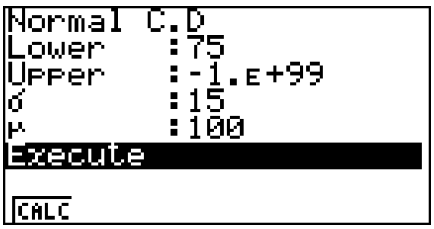
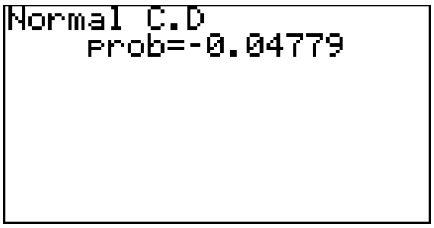
To find the normal cumulative density function for "below":

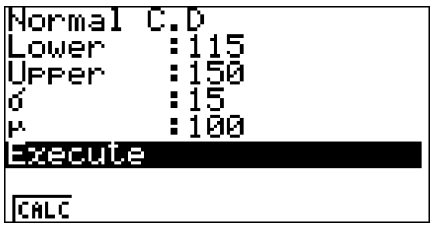
1. Press **EXIT**.
   - With Lower highlighted type **75 EXE**.
   - With Upper highlighted type **(-) 1 EXP 99 EXE**.
   - Arrow down to highlight Execute and press **F1(CALC)**.

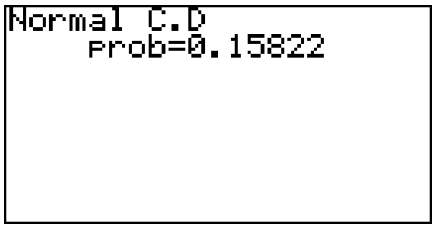




To find the normal cumulative density function for "between":

2. Press **EXIT**.
   - With Lower highlighted type **115 EXE**.
   - With Upper highlighted type **150 EXE**.
   - Arrow down to highlight Execute and press **F1(CALC)**.





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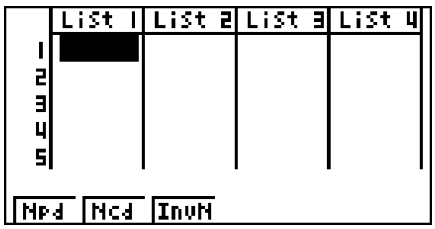
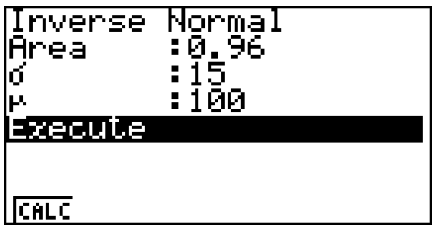
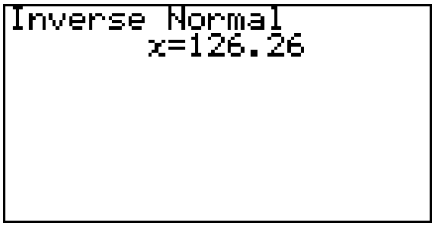
Solutions and Screen Shots for Activity 12
(continued)

To find the inverse normal density function:

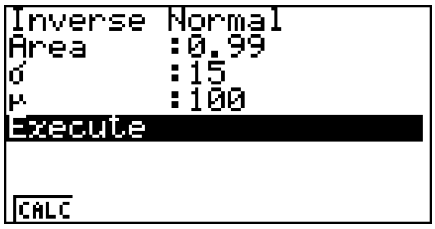
1. Press **EXIT** twice.
2. Press **F5(DIST)**.
3. Press **F1(NORM)**.
4. Press **F3(InvN)**.
   - With Area highlighted type **0.96 EXE**.
   - With σ highlighted type **15 EXE**.
   - With μ highlighted type **100 EXE**.
   - With Execute highlighted press **F1(CALC)**.

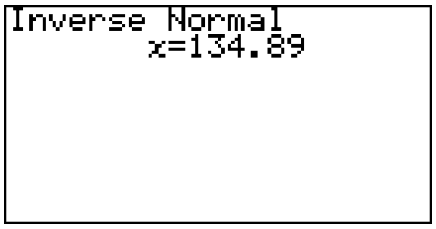






5. Repeat for area of 0.99.





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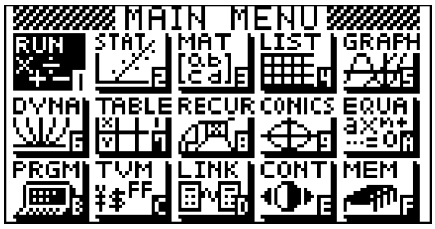
Solutions and Screen Shots for Activity 12
(continued)

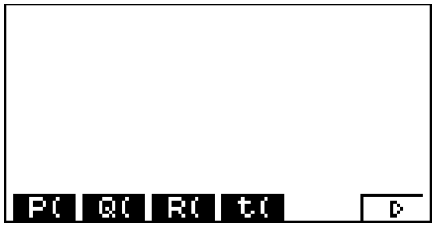
To find IQ scores of outliers:

1. Press **EXIT** twice.
2. Press **MENU**, and select **1(RUN)**.

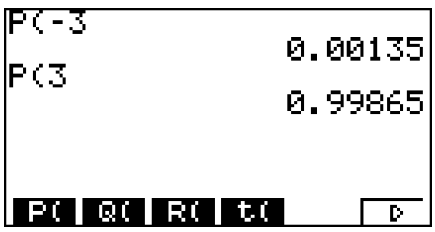


3. Press **OPTN**, **F6**, **F3(PROB)**.

4. Press **F6**, **F1(P()**.



5. Type **(-) 3 EXE**.
6. Press **F1(P()**.
7. Type **3 EXE**.



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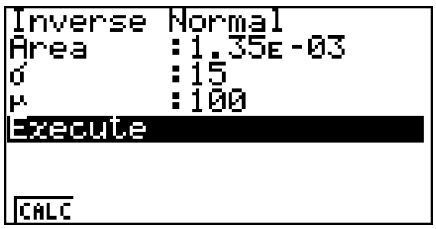
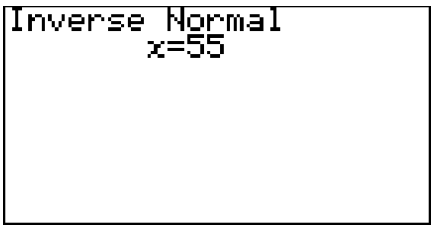
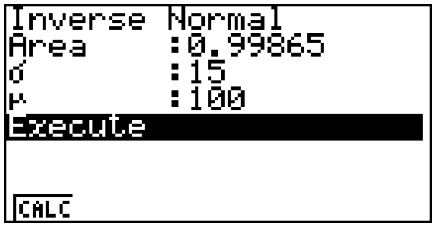
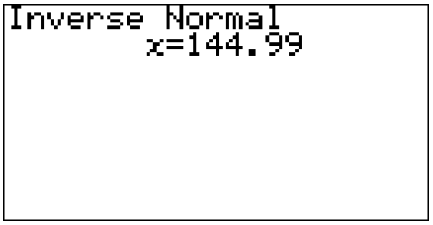
8. Press **MENU** and select **2(STAT)**.
9. Press **F5(DIST)**.
10. Press **F1(NORM)**.
11. Press **F3(InvN)**.
    - With Area highlighted type **0.00135 EXE**.
    - Arrow down to highlight Execute and press **F1(CALC)**.





12. Press **EXIT**.
    - With Area highlighted type **0.99865 EXE**.
    - Arrow down to highlight Execute and press **F1(CALC)**.





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Activity 13
Gas Mileage

Teaching Notes

Topic Area: One-way Analysis of Variance

NCTM Standards:

- Develop and evaluate inferences and predictions that are based on data
  - Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions (9-12)
  - Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference (9-12)

Objective

The students will be able to complete a one-way analysis of variance using sample data.

Introduction

For data that there is more than one level of the independent variable, students cannot perform a t-test. An Analysis of Variance can be used in this case. In this activity, the students will use a one-way analysis of variance because there is only one independent variable, the model type.

An ANOVA makes several assumptions about the data:

- The scores are normally distributed, though it allows for violations of this assumption and can be helpful even when the data is not distributed normally.
- The population variances of the groups are the same, and as long as the group sizes are the relatively the same, violations of this do not cause huge errors in the results.
- The observations are independent of one another.

The null hypothesis for this activity will be that the mean for each model compact SUV is the same. In doing this analysis, the students should be able to see whether the means of the three models are statistically the same. If the null hypothesis is rejected, the student cannot say that the three means are the same.

The students should be familiar with the following vocabulary:
Analysis of variance (ANOVA)
Average

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator and the sample set of data. You may want the students to calculate these values themselves and then check with the calculator.

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Name _____ Class _____ Date _____

Activity 13 • Gas Mileage

Introduction

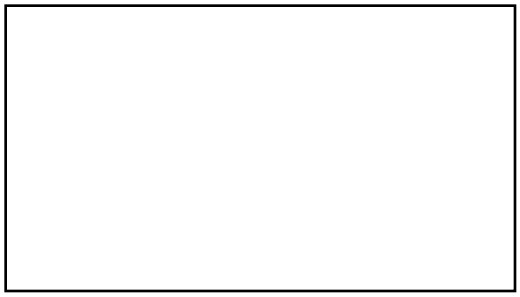
In a controlled study, three popular compact SUV model's gas mileage was tested. Five of each model was tested and the results are reported below.

Model	Gas Mileage (over 500 miles)				
Honda CR-V	26.9	28.5	25.5	27.6	28.7
Toyota RAV-4	28.0	29.0	26.5	30.2	26.2
Saturn VUE	24.0	26.0	27.5	30.0	26.5

Problems and Questions

1. What is the average gas mileage for each of the models? _____

2. Create a parallel box and whiskers plot for each models' gas mileage? Draw and label the plots in the space below.



3. Explain any differences you see in the box plots.

_____

_____

_____

4. Conduct a one-way analysis of variance. Is there evidence to conclude that there is a statistically significant difference in the average gas mileage for each model? Explain.

_____

_____

_____

5. Which model would you choose? Why?

_____

_____

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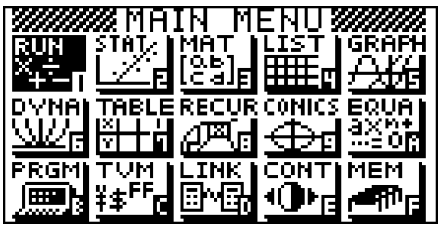
Solutions and Screen Shots for Activity 13

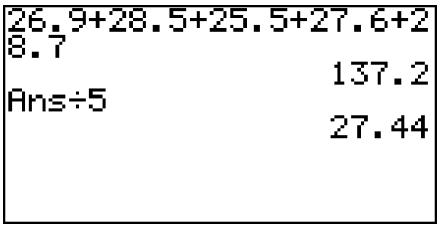
To find the average gas mileage for each of the models:

1. Press the **AC/ON** button, from the main menu press **1(RUN)**.

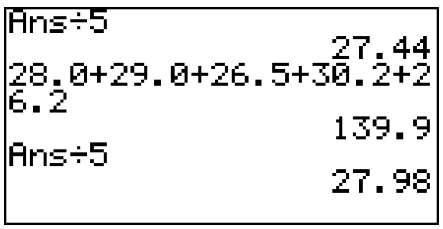


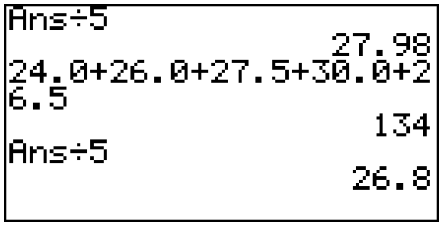
2. Type **26.9 + 28.5 + 25.5 + 27.6 + 28.7 EXE**.
3. Type **÷ 5 EXE**.

   The answer should appear on the screen.



4. Repeat for the Toyota and the Saturn models.





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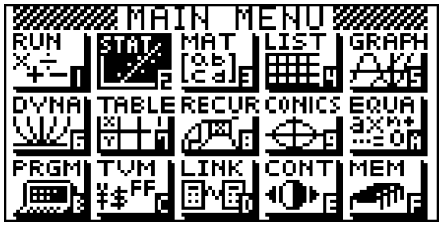
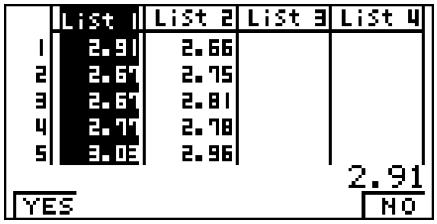
Solutions and Screen Shots for Activity 13
(continued)

To create a box and whiskers plot and find the median and quartile ranges:

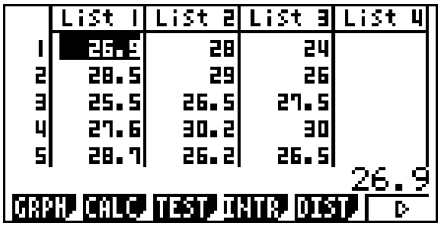
1. Press the **MENU** button from the main menu and press **2(STAT)**.



2. Delete any data that is currently in the lists.
   - If you have data in your lists, place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



3. Enter the Honda data into List 1, Toyota data into List 2, and the Saturn data in List 3.
   - Enter data for Honda into the first cell of list 1, **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Toyota in List 2 and Saturn in List 3.



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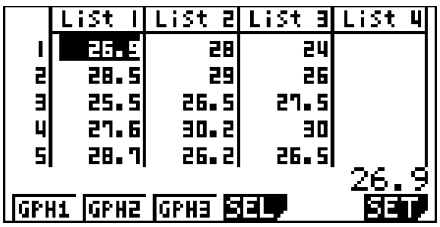
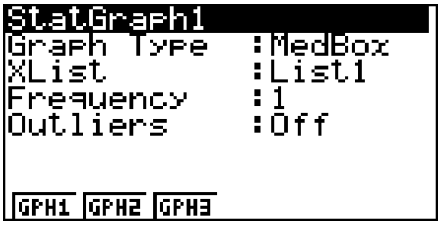
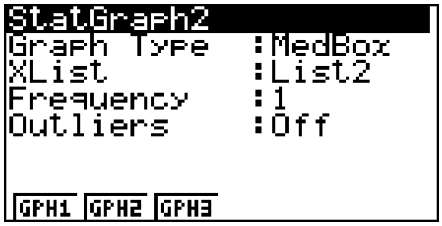
4. Press **F1(GRPH)**, **F6(SET)**.



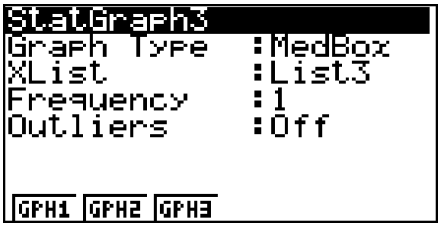
- Arrow down to Graph Type and press **F6**, **F2(Box)**.
- Arrow down to XList and press **F1(List 1)**.



- Arrow up to StatGraph1 and press **F2(GPH2)**.
- Arrow down to Graph Type and press **F6**, **F2(Box)**.
- Arrow down to XList and press **F2(List 2)**.



- Arrow up to StatGraph2 and press **F3(GPH3)**.
- Arrow down to Graph Type and press **F6**, **F2(Box)**.
- Arrow down to XList and press **F3(List 3)**.



- Press **EXIT**.

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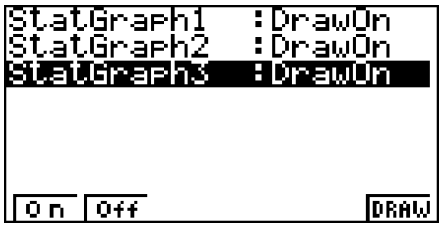
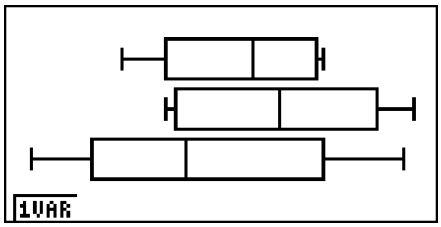
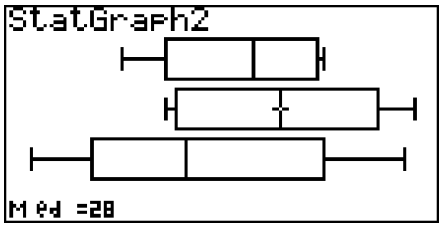
- Press **F4 (SEL)**, **F1(On)**, arrow down to StatGraph2 and press **F1(On)**, arrow down to StatGraph3 and press **F1(On)**, press **F6(DRAW)**.



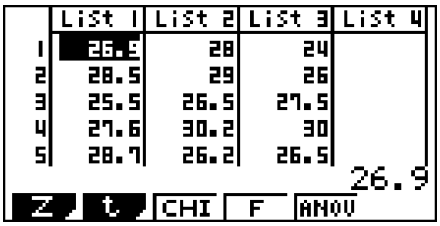


- Press **SHIFT**, **F1(Trace)** to find the median values on each graph. Press the left and right arrow keys to find the data on one graph and press the up and down arrow keys to switch graphs.



To conduct a one-way analysis of variance:

1. Press **EXIT**, **EXIT**.
2. Press **3(TEST)**.
3. Press **F5(ANOV)**.



- Highlight How Many and press **F2(3)**.
- Highlight List 1 and press **F1(List1)**.
- Highlight List 2 and press **F2(List2)**.
- Highlight List 3 and press **F3(List3)**.

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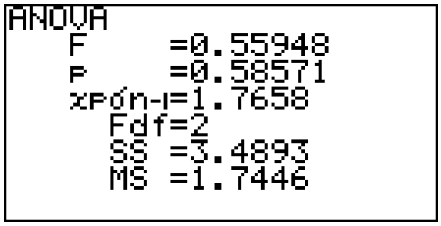
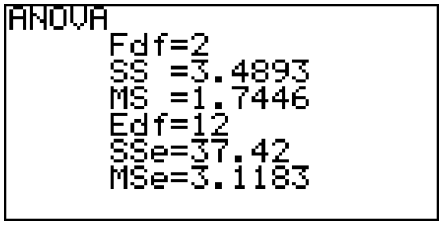
- Highlight Execute and press **F1(CALC)**.

The following values will appear on the screen:

F	F value
p	p-value
xpσn-1	pooled sample standard deviation
F*df*	factor degrees of freedom
SS	factor sum of squares
MS	factor mean squares
E*d*f	error degrees of freedom
SSe	error sum of the squares
MSe	error mean squares





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Activity 14
Bouncing Balls

Teaching Notes

Topic Area: Transformations to Achieve Linearity

NCTM Standards:

- Select and use appropriate statistical methods to analyze data
  - For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools (9-12)
  - Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled (9-12)

Objective

The students will be able to perform a transformation of data to linearize an exponential curve.

Introduction

Transformations to achieve linearity can be helpful especially when dealing with data, especially if the data displays a logarithmic or square root relationship. To do this, the student will take the logarithm or square root of both sides of the equation to give a straight line. After the transformation, the scatterplot of the data should be linear. The students must use the reverse transformation to interpolate and extrapolate information from the graph.

In this activity, the students will measure the decay of the height of a bouncing ball. They will measure, record, plot, and complete a transformation to achieve linearity for their data. They will also use that to extrapolate information from the equations given.

The students should be familiar with the following vocabulary:

Transformation	Extrapolate
Linearity	Interpolate
Regression	
Slope	

Getting Started

For this activity you will need the **Casio fx-9750G Plus** graphing calculator, a rubber ball (super ball), and a measuring tape (2 meters) for each pair of students.

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Name _____ Class _____ Date _____

Activity 14 • Bouncing Balls

Introduction

Take a partner, a rubber ball, and a measuring tape to a space next to a wall. Line up the meter stick vertically against the wall. From about one meter off the ground, let the ball bounce close to the measuring tape. Measure where the ball bounces on the first through sixth bounce. Repeat this three times and calculate the average height for each bounce. Record the data in the chart below:

Bounce	Height Trial 1 (m)	Height Trial 2 (m)	Height Trial 3 (m)	Average Height (m)
0				
1				
2				
3				
4				
5				
6				

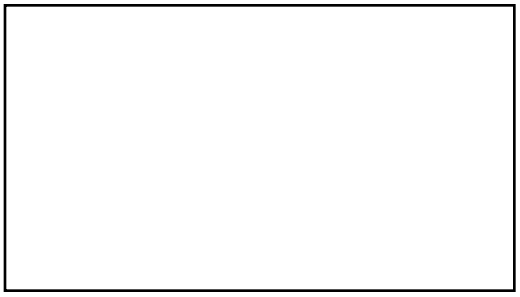
Problems and Questions

1. What type of relationship is there between bounce number and bounce height? How do you know?

_____

_____

2. Plot a scatterplot of bounce height versus bounce number. Draw the scatterplot in the box below.



3. What is the non-linear regression equation for this graph? What do the values in your equation mean?

_____

_____

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Name _____ Class _____ Date _____

Activity 14 • Bouncing Balls (continued)

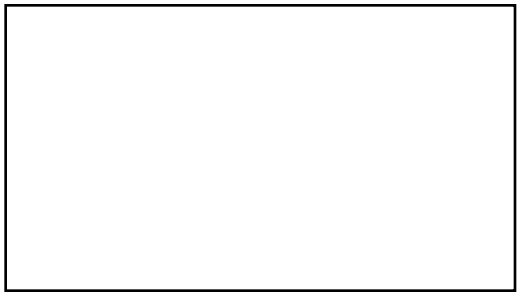
4. What transformation would you do to achieve a linear graph?

_____

_____

5. Complete a table of values for the linearized data.

6. Plot a scatterplot of the linearized data and draw it in the box below.



7. What is the regression equation of your graph? What do the values in your equation mean?

_____

_____

_____

8. Using your linearized graph, extrapolate what the bounce height would be after 7 bounces?

_____

_____

_____

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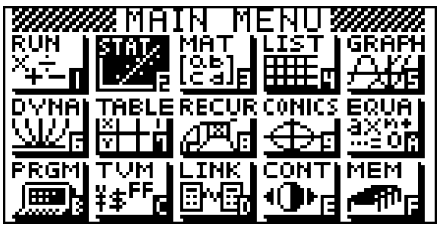
Solutions and Screen Shots for Activity 14

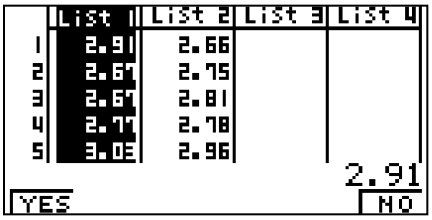
Bounce	Height Trial 1 (m)	Height Trial 2 (m)	Height Trial 3 (m)	Average Height (m)
0	1.5	1.5	1.5	1.5
1	1.18	1.25	1.21	1.21
2	0.91	0.96	0.93	0.93
3	0.75	0.79	0.79	0.78
4	0.63	0.62	0.61	0.62
5	0.48	0.46	0.44	0.46
6	0.31	0.30	0.30	0.30

To find the average bounce height and plot a scatterplot of the data:

1. Press the **AC/ON** button, from the main menu press **2(STAT)**.



2. Delete any data that is currently in the lists.
   - If you have data in your lists, place the cursor within the list with data in it and press **F6**, **F4(DEL-A)**, then **F1(YES)**. Repeat until all data is deleted. Press **F6**.



3. Enter the bounce number in List 1, Trial 1 data into List 2, Trial 2 data into List 3, and the Trial 3 data in List 4.
   - Enter bounce number into the first cell of List 1and press **EXE**.
   - Repeat until all data are entered into List 1.
   - Repeat for Trial 1 in List 2, Trial 2 in List 3, and Trial 3 in List 4.

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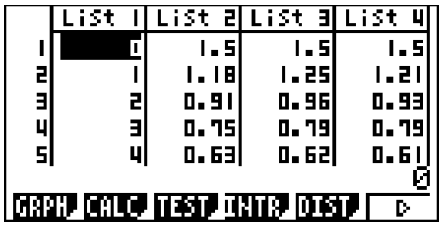
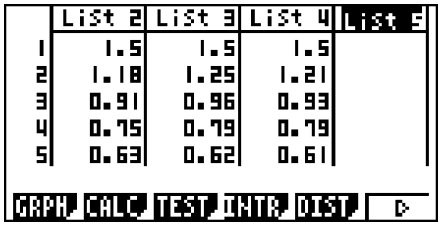
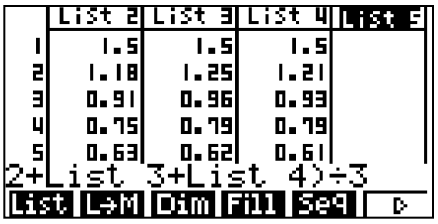
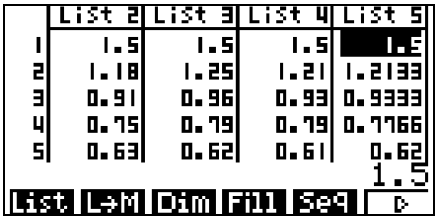


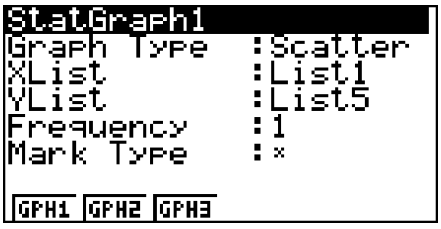
4. With the word List 5 highlighted, press **OPTN**, **F1(LIST)**, **(F1(List)**, **2 + F1(List)**, **3 + F1(List)**, **4)**, **÷ 3 EXE**. The average height should appear in List 5.







5. Press **EXIT**, **EXIT**, **F1(GRPH)**, **F6(SET)**.
   - Arrow down to Graph Type and press **F1(Scat)**.
   - Arrow down to XList and press **F1(List 1)**.
   - Arrow down to YList and press **F5(List 5)**.



   - Press **EXIT**.

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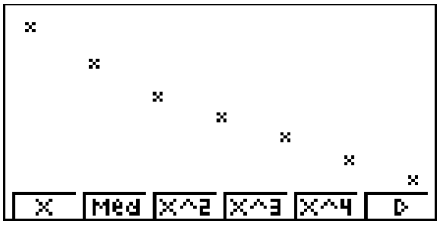
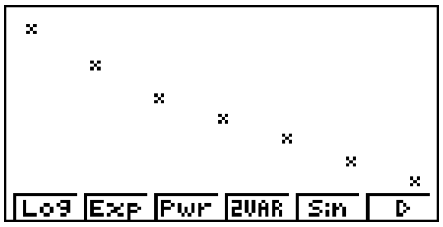
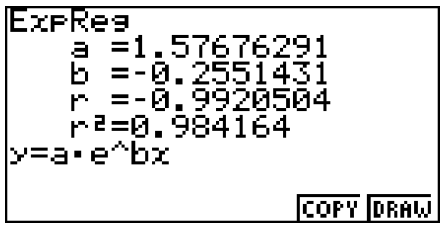
6. Press **F1(GPH1)**.

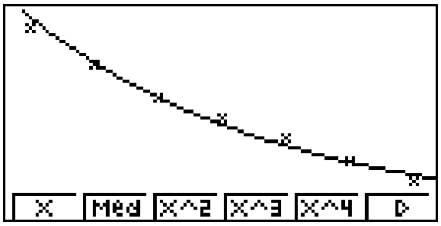


7. Press **F6**, **F2(Exp)**.





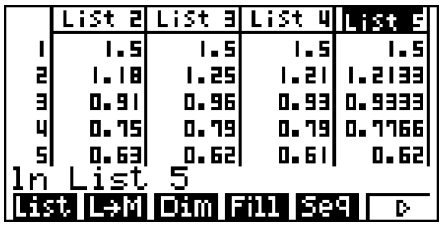
8. Press **F6(DRAW)**.

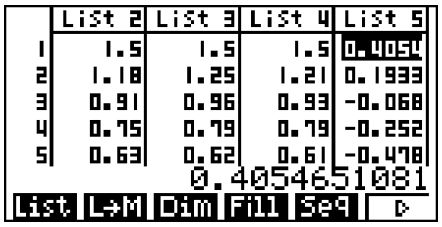


To find a table of values for linearized data, graph linearized scatterplot, and find linear regression:

1. Press **EXIT**.
2. With the word List 5 highlighted, press **OPTN**, **F1(LIST)**, ln, **F1(List)**, **5** **EXE**.

   The linearized data should appear in List 5.





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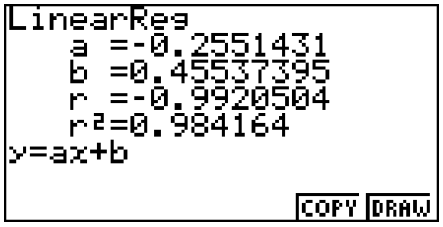
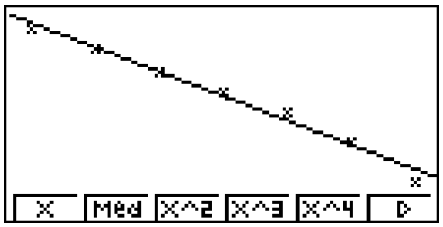
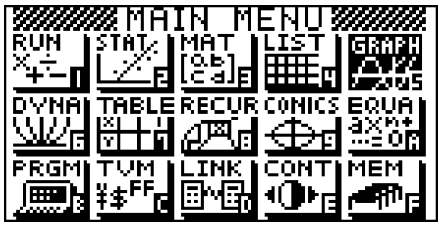
3. Press **EXIT**, **EXIT**, **F1(GRPH)**, **F1(GPH1)**.
4. Press **F1(x)**.
5. Press **F5(COPY)**, **EXE** to store the equation for later analysis.
6. Press **F6(DRAW)**.

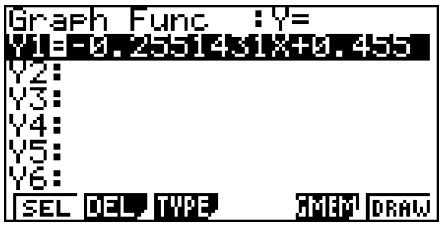




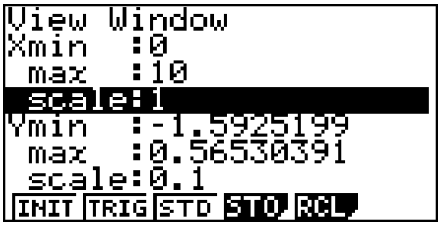
To find extrapolated data:

1. Press **EXIT**, **EXIT**.
2. Press **MENU** and press **5(GRAPH)**.
   The equation is stored in the graph function Y1.





3. Set up the viewing window by pressing **SHIFT**, **F3(V-Window)**. Make sure the Xmin is set by typing **0 EXE** and Xmax is set by typing **10 EXE**.



4. Press **EXIT**.

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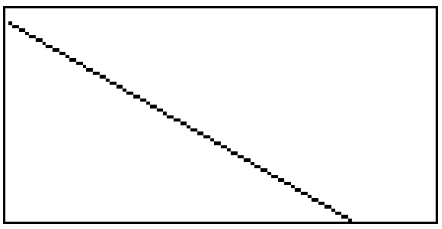
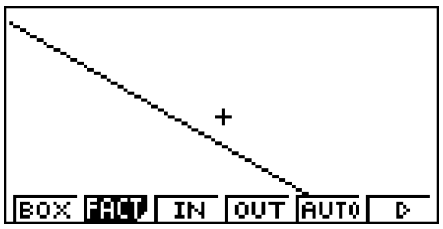
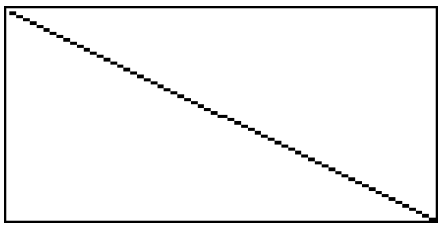
5. Press **F6(DRAW)**.

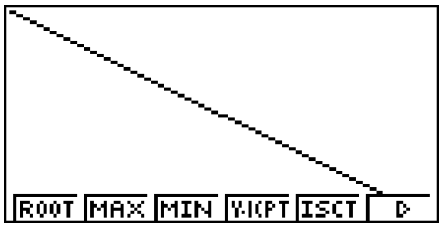


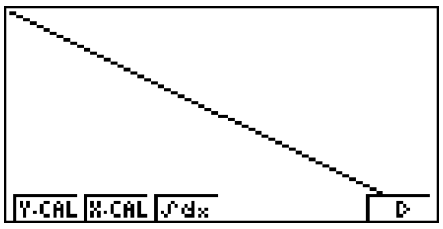
6. Press **SHIFT**, **F2(ZOOM)**, **F5(AUTO)**.

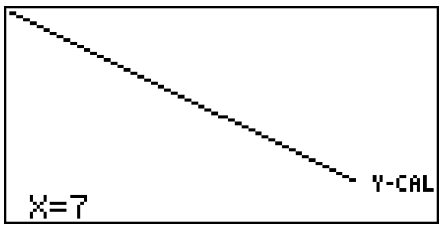


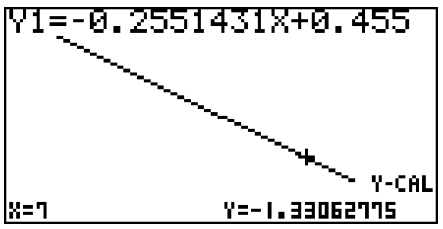


7. Press **SHIFT**, **F5(G-Solve)**.
8. Press **F6**, **F1(Y-CAL)**, **7 EXE**.
   The solution should appear on the bottom of the screen.









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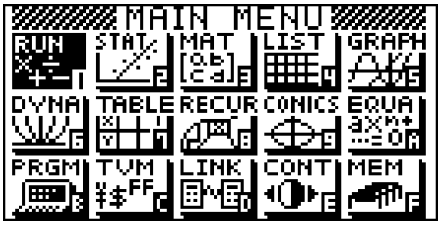
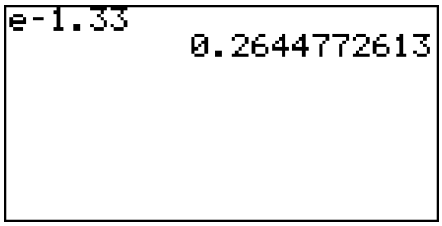
9. Press **EXIT**, **MENU**, **1(RUN)**.
10. Press **SHIFT**, ln, **(-) 1.33 EXE**.





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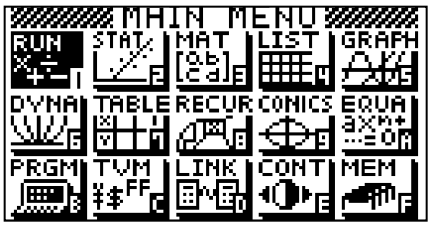
Appendix A
Overview of the Calculator Functions

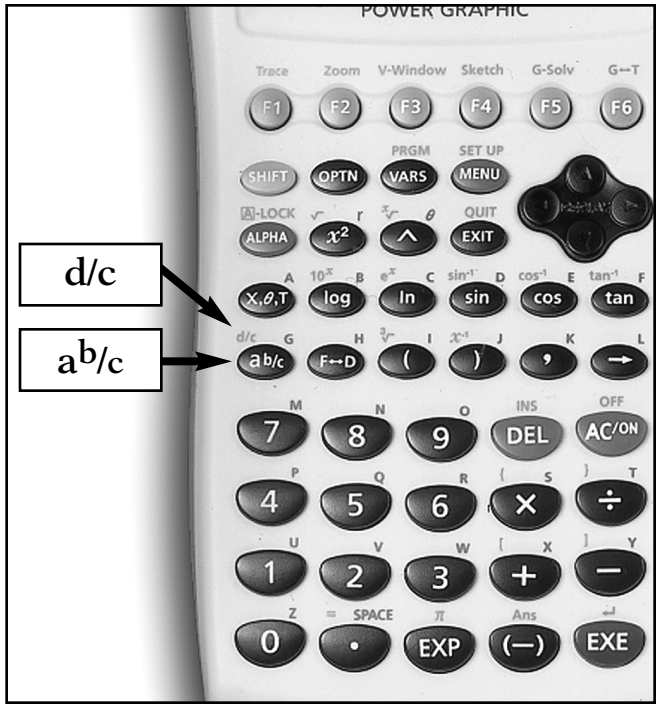
This is not meant to be an exhaustive tutorial. This overview is to provide a starting point when beginning to use the **Casio fx-9750G Plus** graphing calculator.

Run Function



The **Casio fx-9750G Plus** is just like any other calculator when in the run function. There are a few extra functions it offers that other calculators do not.

Fraction calculations:
Using the **a^{b}/c** key, you can enter numbers as fractions and do any normal mathematical operations. The **EXE** will give you answers in fraction or mixed number format. You can change from fraction format to a decimal format by pressing the **F↔D** key and vice versa. You may also change the mixed number to an improper fraction by pressing **SHIFT a^{b}/c** for **d/c**. This function will only work if the expression is entered in fraction format originally.



Editing:
If you need to make a change in a previous calculation, use the deep recall to retrieve the equation. In the Run function, press the **AC/ON** to clear the screen. Then use the Up Arrow key to scroll through the previous equations until you come to the one you want to edit. Press the left arrow key to make the changes desired. **Note the previous calculations will be lost as soon as you exit the Run function.*

Probability:
In the Run function, press the **OPTN** (option) menu. Press the **F6** (arrow right) for more options. Then press the **F3(PROB)** function. This will allow you to do factorials, permutations, combinations, and random numbers.

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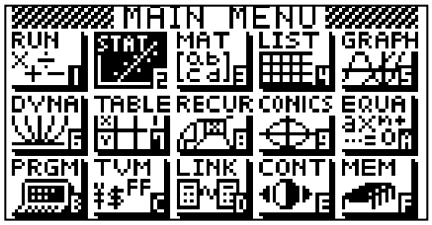
Statistics Function



Entering Data:
If there are statistics in the lists, press **F6** for more options, then press **F4(DEL-A)** and **F1(YES).** Enter the data in List 1 by entering the number and pressing **EXE**. When you press **EXE** the number will show up in the list. After the list is complete, you can begin calculating the statistics.

Statistics:
Press **F2** to show the **CALC** options. Check the **F6(SET)** for the setup of the calculations. Make sure that the 1Var XList is set at List 1 by highlighting it and pressing **F1**. Press **EXIT** to get back to the previous screen and press **F1(1VAR)**. Arrow down to see other statistics.

Exit out:
Press **EXIT** twice to get back to the statistics lists.

Box and Whiskers:
Using the same data as in a histogram, you can make a box and whiskers graph. From the graph option menu, press **F6(SET)**. Arrow down to graph type and set to Box. Press **EXIT** to get back to the previous screen. Check to see if graph 1 is selected in the **SEL** option, and press **F6(DRAW)**. Statistics can be seen from here by pressing **F1(1VAR)**. **SHIFT F1(Trace)** will allow you to trace the graph for quartile ranges using the right arrow key. Press **EXIT** twice to return to the **STAT** window.

Scatter Plot:
Enter data in lists 1 and 2 as done above. Press **F1(GRPH)** options then **F6(SET)**. Arrow down to graph type and set at **SCAT**ter. Make sure that XList and YList are set at List1 and List2 respectively. Press **EXIT** and then press **F1** to see Grph1. If the graph does not appear, **EXIT** and press **F4(SEL)** to make sure only Graph 1 is turned on.

Line of Best Fit:
On the screen with the graph are options for different kinds of regressions. Press the regression you think will fit the data the best and the calculator will give you a regression analysis. Notice the choices at the bottom of the screen. If you press the **F5(COPY)**, it will copy the line to the **GRAPH** function so that you can see the graph later, if needed. After you press **F5(COPY)**, press **EXE** to store the graph and it will take you back to the regression information. Press **F6(DRAW)** function to see the graph.

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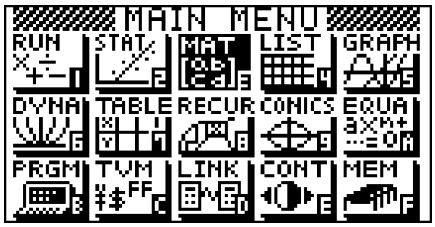
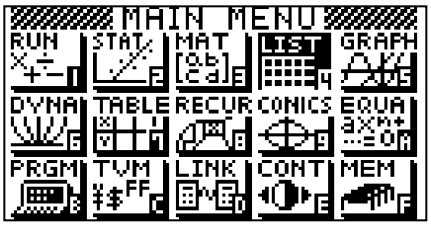
Matrix Function



Entering Matrices:
In the matrix function, you will see a list of matrices you can enter. With the first available matrix highlighted, enter the number of rows needed first and then the number of columns. Press **EXE** after each entry. After the second **EXE**, the actual matrix will show up on the screen. When you enter the matrix, the numbers will go across first and then down to the next row. From this screen, you can do basic matrix operations by pressing **F1(R-OP)**. You can add and switch rows here.

Matrix Operations:
Most other basic matrix operations can be done in the Run function. Press **OPTN** in the Run function and then press **F2(MAT)** for matrix operations. You can add and subtract matrices, find the determinant, transpose, augment, send a matrix to lists, and finding the identity of a matrix. After the function has been entered, press **EXE** to see the resulting matrix.

List Function



Sorting data:
The data entered in the statistics lists will show up here as well. If you would like to erase the lists, highlight the list and press **F4(DEL-A)**. Then enter the new data as before. You may sort the data by pressing **F1**. It will prompt you by asking how many lists, then it will prompt you to select a list. When sorting more than one list, the calculator will ask for a base list and a second or third list. You can sort the data in ascending (SRT-A) order or descending order (SRT-D).

Other Operations:
Press the **OPTN** key for more options in the List function. These options include moving matrices, finding the minimum, maximum, mean, median, mode, and product of lists.

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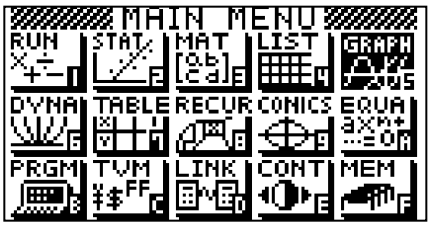
Graph Function



Entering Equations:
When you enter the graph function, the graph edit screen is up. Type in an equation using the X**θT** or the letter **X** button for the variable X. You can change the Y= to an inequality by pressing **F3(TYPE)** before entering in the equation. Press **F6** for more options for the equation. Press **EXIT** to get back out to the original options. Press **F6(DRAW)** to see the graph.

View of the Graph:
If the graph cannot be seen, press **SHIFT F3(V-window)**. Press **F3(STD)** for a standard 20-interval view, press **F1(INIT)** for initial settings, and **F2(TRIG)** for a standard trigonometry function. You may also set the setting manually and store that setting by pressing **F4(STO)**. Press **EXIT** to get back to the graph-edit screen. You may view more than one graph at a time by pressing **F1** on each graph you want to show. This is how you can solve systems of equations.

Dual Screen:
In the graph function, press **SHIFT(SETUP)**. Arrow down to Dual Screen and switch it to Graph by pressing **F1**. Press **EXIT** to get to the previous screen. Notice when you press **DRAW**, whatever picture of the graph was last seen will be on the left, and the frame on the right will be blank. Zoom in on the graph and that part of the graph will show up on the right. You may also use the dual screen for a graph and a table. Go into the setup again and change the dual screen to **G to T** for Graph to Table. Press **EXIT** to get back to the edit screen. The graph will appear with a blank table. Press **SHIFT F1**(**Trace)** to trace values on the graph. To put those values in the table press **EXE**. Put multiple values in the table by pressing **EXE** repeatedly.

Solving for a Specific Point:
After you graph two inequalities you can find the point of intersection of those graphs by using the G-solve function. Press **F5(G-Solv)** (you do not have to press the **SHIFT** key if the graphs are already on the screen). Press **F5(ISCT)**. The calculator will think for a few seconds and then trace the graph to the intersection point for you. You can also find the roots, maximum, minimum, y-intercept, y and x coordinates for given values, and definite integrals.

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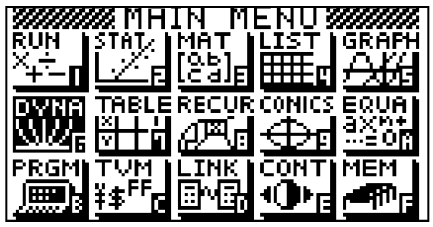
Dynamic Function



Built in List of Equations:
The dynamic function is used to demonstrate the effect of changing certain variables in an equation. There are seven built in functions that are common in basic algebra and trigonometry. To get to this list, press **F5(B-IN)** after you are in the Dynamic function. To choose one of the built-in functions, highlight and press **F1(SEL)**.

Setting the Variable and Speed:
After choosing the equation in question, press **F4(VAR)** to choose the active variable. Highlight the variable you want to change and enter in values for the other variables. Notice the arrow to the right of the Dynamic Variable. That is the speed indication. Press **F3(SPEED)** to change the speed of the dynamic function. Highlight the desired speed and press **F1(SEL)**. Each speed has a different symbol. This symbol is shown next to the variable on the previous screen. Press **EXIT** to return to that screen.

Setting the range:
In the dynamic variable screen, press **F2(RANG)**. Set the start and end of the range you want to show. The pitch is the interval between numbers in range. Press **EXIT** to get to the previous screen.

Viewing the dynamic graph:
In the Dynamic Variable screen, press **F6(DYNA)**. When you do this, the calculator will say "One Moment Please" while loading the graph. Once the graph is on the screen, press **EXE** to see the change in the variable. When you press the **EXE**, notice the active variable will change.

Entering equations manually:
If the equation you need is not in the built-in list you can enter the equation in manually. Use the alpha key and letters to enter variables. The variables entered in manually will be available in the dynamic function.

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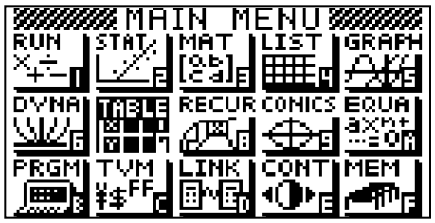
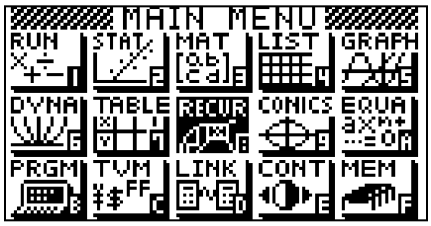
Table Function



Entering Equations:
Equations that have been entered into the graph function or dynamic function will show up here. To delete the equation, press **F2, F1**. Enter an equation. Set the type and range. Press **F6(TABL)** to see the table. The x-values are located in the first column and the y-values in the second. In the table you can type any value for x and press **EXE** and the calculator will calculate the y-value.

Viewing a Graph of the function:
The two choices at the bottom of the table screen are **G-CON** and **G-PLT**. Press **F5(G-CON)**, a connected graph, and press **F6(G-PLT)**, a scatter graph of the function.

Recursion Function



Inputting Recursion Formulas:
Go into the Recursion function by pressing **8**. Once in the function, you must select what type of recursion function you would like. Press **F3(TYPE)**. Select the type of recursion by pressing the corresponding **F1**, **F2**, or **F3**. This will choose between sequences of one, two, and three terms respectively. Two enter in a equation press **F4** for variable options. After the equation is entered, press **EXE** to store.

Creating a Table:
You must first set the range of the table. Set the range by pressing **F5(RANG)**. The range specifies the start and ending value for the variable n, where a and b should start, and where the pointer starting point is on the graph. Press **F2(a1),** then enter in your values for start, end, and a1. The variable n will go in increments of 1. **EXIT** back out to the equation and press **F6(TABL)** to see the table. The options for the table appear across the bottom of the screen.

You have four options: to delete the recursion formula table, to draw a connected line graph of the formula, to draw a plot type graph of the formula, or to draw a graph and analysis of the convergence/divergence of the graph (WEB). **FORM** takes you back to the formula.

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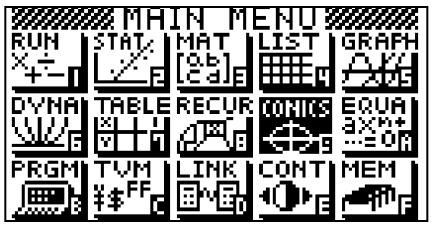
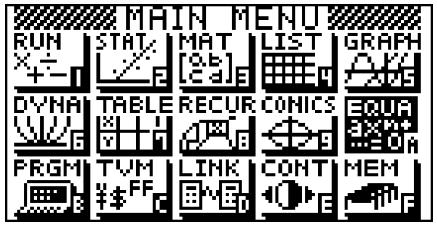
Conics Function



Graphing a Conic:
In the Main Menu, press **9** for **Conics**. The first screen you come to will be a choice of conic equations already input into the calculator memory. Choose one by arrowing and highlighting the chosen equation and press **EXE**. Then enter the values in for the variables in the equation as listed. After each value entered, press **EXE** to store and move to the next value. Press **F6(DRAW)** to see the graph of the conic equation. Note, the graph of a circle may not necessarily show up as a circle because the view window needs to be set manually (Choose a X-value that is twice as large as the Y-value to get a perfect circle).

Equation Function



Solving Systems of Equations:
To solve for a system of equations, select the equation function by pressing the **XθT** button. Choose **F1** for Simultaneous equations. Choose the number of unknowns you have by pressing the corresponding function key. Enter in the values for each of variables in the equations. After the values are entered in, press **F1(SOLV)**. The calculator will solve for the unknown values. REPT at the bottom of the screen will take you back to the previous screen.

Solving for a Variable in Polynomials:
You can solve for a variable in polynomials up to the third degree. Press **F2** for Polynomial when you enter the equation function. The calculator will ask you to specify the degree of the polynomial by pressing either **F1** for **2** or **F2** for **3**. Enter in the values for the polynomial in the matrix shown and then press **F1(SOLV)**. The two values for X will show up in a matrix.

Solving Equations:
Enter into the equation solver by pressing **F3** for Solver. To enter the equation in question, you may enter numbers, alpha-characters, and symbols. If you do not put an equals sign in the equation the calculator will assume that the equation is to the left of the equals sign and that a zero follows it. To specify a letter or number other than zero, type **SHIFT**, = and then type the value. After the equation is entered, press **EXE** to store. The variables in the equation will

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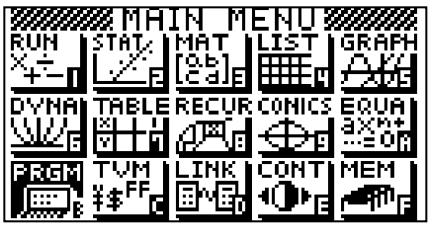
show up on the screen. Enter the known values and press **EXE** to store each one. Highlight the unknown value and then press **F6(SOLV)**. The value for the unknown will be shown as well as the value for the left-hand side and right-hand side of the equation to show how accurate the answer is.

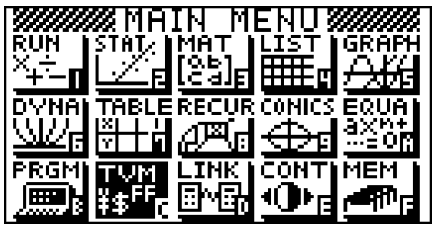
Program Function



Running Programs:
After you are in the program function, highlight the program you would like to run and press **F1(EXE)**.

Other Options:
In this function you can also **EDIT** a program, create a **NEW** program, **DEL** a program, or **DEL**-All programs. If you press **F6** for more options, you can also find (SRC) a program or rename (REN) a program.

Time Value of Money Function



Doing Financial Calculations:
In the financial function you have the ability to calculate several variables using simple interest, compound interest, cash flow, amortization, conversion, cost, selling, price, margin, and day and date calculation. There are many abbreviations in the different modes of the function:

APR: annual percentage rate
BAL: balance of principal after installment
C/Y: compounding periods per year
Csh: list for cash flow
Cst: cost
D: number of days
d1: date 1
d2: date 2
EFF: effective interest rate
FV: future value
I%: periodic/ annual interest rate
INT: interest portion of installment
IRR: internal rate of return
Mrg: margin
n: number of compound periods
NFV: net future value
NPV: net present value
P/Y: installment periods per year
PBP: pay back period
PM1: first installment
PM2: second installment
PMT: payment
PRN: principal portion of installment
PV: present value
Sel: selling price
SFV: simple future value
SI: Simple Interest
SINT: total interest from installment PM1 to installment PM2
SPRN: total principal from installment PM1 to installment PM2

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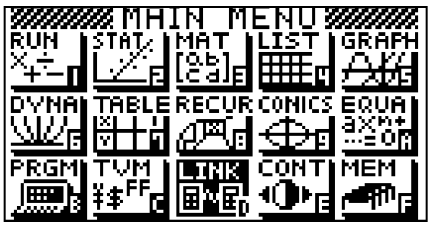
Link Function

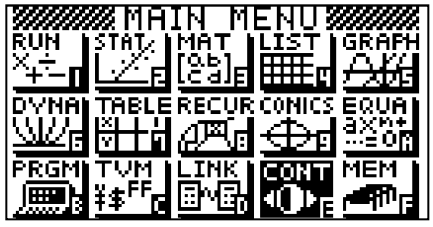


Transmitting:
The link function is used to transmit and receive data from other calculators. Calculators can share information from the program list, tables, graphs, lists, and statistics. By pressing **F1** you can transmit data to another calculator. The calculator will ask for the type of transmission you are making. At this point, **F1** will allow you to select what you want to transmit. The calculator will give you a list that consists of lists, matrices, files, graphs, pictures, variables, and receive 1 and receive 2. The receive options are for receiving 1 list or 2 lists simultaneously. Select from this list what to transmit and press **F6** for the transmission.

Receiving:
The only thing required for receiving data is the press **F2(REC).** The transmitting calculator must do all the work!

Image Set Mode:
In the Link function menu, **F6** is the image set mode. The images are sent by pressing the **F**÷**D** key. **Note that the F÷D key will not change a fraction to a decimal or vice versa if the image set mode is set to monochrome. The shift between decimals to fraction can occur only if the image set mode is turned off.*

Contrast Function



Setting the Contrast:
You can adjust the contrast of the screen by using the left and right arrow keys. Press the right arrow key to darken the contrast and the left arrow key to lighten the contrast.

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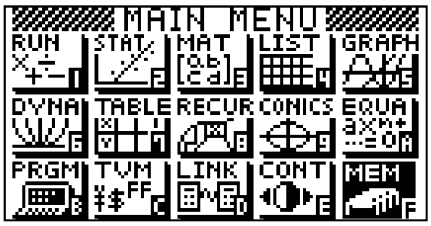
Memory Function



Memory Usage:
To check memory usage, select it by highlighting it and pressing **EXE**. You can delete entire sections of the memory as listed only. You cannot delete individual lists or programs from here. This tool is useful to see where you have memory used and how much memory you have left on the calculator. The calculator will give you the option of backing out before you erase any section.

Resetting Memory:
Highlight the Reset option and press **EXE**. This option will reset the entire memory of the calculator. This will clear all programs and any statistics, graphs, matrices, lists, tables, and equations you have entered. The calculator will again let you back out if you accidentally press Reset.

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Appendix B
Resources of Interest

Casio Education
www.casioeducation.com
An education based website sponsored by Casio, Inc. From this site you will find links to purchasing calculators, free downloads of programs and curriculum, and Casio Rewards program and monthly student contests.

Charlie Watson Site
http://www.charliewatson.com/casio/casprog.html
This is a rather large database of calculator programs on the Casio. Along the right-hand side of the screen is a list of categories for the programs that may be of interest. You can download the programs and link them to the calculator.

Casio Programs from Ted Cannelongo
www.geocities.com/SiliconValley/1949/casio.html
This is a site that includes various links to downloadable programs written to supplement and demonstrate functions and statistics in the mathematics classroom.

National Center for Education Statistics
http://nces.ed.gov/
This website is a starting point for finding any type of statistics related to education in the United States. This is a great resource for instructors interested in finding out how statistics are used in the field of education or for students interested in the same.

Ask Dr. Math, High School Statistics
http://mathforum.org/library/drmath/sets/high_statistics.html
This is a website with tutorial information on basic statistics. As an instructor you can use this to help those students who may need a little extra help in your class.

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